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VOL. CXXXVIII.—No. 3582] LONDON: FRIDAY EVENING, AUGUST 22, 1924 [PRICE ONE SHILLING BY INLAND POST 1s. 3d.

The Engineer

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The Position of British Shipbuilding.

PUBLIC NOTICES

HEATING, &c.

The Commissioners of His Majesty's Works, &c., are prepared to receive TENDERS before 11 a.m. on Friday, 5th September, 1924, for the INSTALLATION of a LOW-PRESSURE HOT WATER HEATING SYSTEM at the Bank Telephone Exchange, Liverpool.

Bills of quantities, &c., and forms of Tender may be obtained from the Contracts Branch, H.M. Office of Works, King Charles-street, London, S.W. 1, on payment of One Guinea (cheques payable to the Secretary, H.M. Office of Works). The sums so paid will be returned to those persons who send in Tenders in conformity with the conditions. 6705

The Director-General, India Store Department, Branch No. 15, Belvedere-road, Lambeth, S.E. 1, REQUIRES:—

ZINC TILES.

Tenders due on the 5th September, 1924.
Tender forms obtainable from above. 6722

Assistant Locomotive SUPERINTENDENT REQUIRED for the NIGERIAN GOVERNMENT RAILWAY, for two tours of from 12 to 18 months' service, with prospect of permanency. Salary £480 a year for the first three years, then £510, rising by annual increments of £30 to £720, and thence by annual increments of £40 to £920. Outfit allowance of £60 on first appointment. Free quarters and first-class passage and liberal leave on full salary. Candidates, age 28 to 35, should be of good education and preferably possess an approved Engineering Diploma. They should have had a thorough training in the workshops of a British Railway or well-known Locomotive Firm, should be conversant with the Repair and Erection of Locomotives, Carriages and Wagons, and be well up in Drawing-office Work. Preference will be given to applicants who have acted in a supervising capacity.

Apply at once by letter, stating age and particulars of experience, to the CROWN AGENTS FOR THE COLONIES, 4, Millbank, Westminster, S.W. 1, quoting M/Nigeria 13,001. 6509

Assistants (Three) REQUIRED by the GOVERNMENT of HONG KONG for service in the ARCHITECTURAL OFFICE of the PUBLIC WORKS DEPARTMENT, for a period of three years, with possible permanency. Salary £460, rising by annual increments of £20 to £500 a year, and thence (if appointment is made permanent) to £950 a year, payable locally in dollars at the Government rate of exchange, which is at present fixed at 2s. to the dollar. In addition, a strictly temporary exchange allowance of 20 per cent. of salary is at present paid. Candidates, unmarried, 24 to 32 years of age, must be duly qualified Architects' Assistants and Associates of the R.I.B.A., should be experienced in Design and the Preparation of Working Drawings, Details and Specifications, and have some knowledge of Quantities. Experience in the Design and Erection of Steel-framed Buildings and a working knowledge of Reinforced Concrete is desirable.—Apply at once, by letter, stating age, qualifications and experience, to the CROWN AGENTS FOR THE COLONIES, 4, Millbank, Westminster, S.W. 1, quoting M/12,919. 6677

Locomotive Assistant REQUIRED for the JAMAICA GOVERNMENT RAILWAY for three years' service, with possible extension. Salary, £578-£25-£650 a year. Free passages, and, if married, for wife and children also, not exceeding four persons beside the person engaged. Candidates, age 20 to 45, must have served a pupilage in the Locomotive Shops of a British Railway and have had subsequent experience in the Running Sheds, also in the Running Department. Experience in Carriage and Wagon Building and Repairs, also in the Drawing-office is desirable.—Apply at once by letter, stating age, whether married or single, and giving particulars of experience to the CROWN AGENTS FOR THE COLONIES, 4, Millbank, Westminster, S.W. 1, quoting M/12,955. 6700

University of Birmingham.

FACULTY OF SCIENCE.

ENGINEERING DEPARTMENTS.

I.—MECHANICAL ENGINEERING.
Chance Professor: F. W. BURSTALL, M.Sc., M.A. (Cantab.), M. Inst. C.E., M. Inst. M.E.
Lecturer: R. C. PORTER, M.Sc. (Vict.), A.M. Inst. C.E.
Demonstrator: S. J. ELLIS, B.Sc., A.M.I.C.E.
Lecturer on Machine Design: F. H. BODEN, B.Sc.
Assistant Lecturer on Machine Design: H. P. DEAN, B.Sc.

II.—CIVIL ENGINEERING.
Beale Professor: CYRIL BATHO, D.Sc., B.Eng.
Lecturers: E. C. PANTON, M.Sc.
H. W. COULTAS, M.Sc.
T. H. P. VEAL, B.Sc.
Lecturer on Town Planning: W. HAYWOOD.

III.—ELECTRICAL ENGINEERING.
Professor: WILLIAM CRAMP, D.Sc.
Lecturer: E. J. KIPPS, M.Sc., M. Inst. E.E.
Assistant Lecturers and Demonstrators: O. R. RANDALL, M.Sc.
G. M. HARVEY, M.Sc., B.Eng.

THE FULL COURSES EXTEND OVER FOUR YEARS, and students who enter after Matriculation and pass successfully the examinations at the end of each year will be ENTITLED to the DEGREE of BACHELOR OF SCIENCE in Engineering.

THE SESSION 1924-25 COMMENCES on OCTOBER 6th, 1924.

For detailed syllabus of the Faculty with full particulars of University Regulations, Lecture and Laboratory Courses, Fees, &c., apply to the REGISTRAR. 6452

University of Manchester.

PHYSICS DEPARTMENT.

Full particulars of the LECTURES and LABORATORY COURSES in PHYSICS, preparing for both the Ordinary and the Honours Degrees, will be forwarded on application to the INTERNAL REGISTRAR. 6719

Heriot-Watt College, EDINBURGH.

Principal: A. P. LAURIE, M.A., D.Sc.

ENGINEERING.

Complete Diploma Courses in MECHANICAL ENGINEERING, ELECTRICAL ENGINEERING and MINING ENGINEERING (COAL, METALLIFEROUS, OIL).

CHEMISTRY.

Courses for Diploma and Associateship of College in Organic and Mineral Chemistry, Metallurgy and Assaying, Oil Technology, Industrial Bacteriology, and for the Brewers' Certificate and Brewers' and Analysts' Diploma, also for the Associateship of the Institute of Chemistry (A.I.C.), and for the B.Sc. Degree of Edinburgh University in Technical Chemistry and the B.Sc. Degree of London (Pass and Honours).

The Associateship of the College in Chemistry is recognised by the Institute of Chemistry as exempting from examinations for the Associateship of the Institute of Chemistry (A.I.C.).

Laboratories equipped for Research Students.

PHARMACY.

Courses for Students preparing for the Professional Examinations of the Pharmaceutical Society of Great Britain ("Qualifying" and "Major" Examinations).

Courses in BUILDING CONSTRUCTION for Builders' Clerks and Surveyors, and in PRINTING for those engaged in the Printing and the Allied Trades.

Entrance Bursary of £25. Schedules on Application.

CLASSES OPEN ON 14th OCTOBER.

Entrance and Bursary Examination commences on 23rd September.

Prospectus on application to Principal at the College.

G. MALCOLM STUART, W.S., Clerk to the Governors.

Heriot Trust Offices, 20, York-place, Edinburgh. 6665

University of Manchester.

DEPARTMENT OF ELECTRICAL ENGINEERING.

DEPARTMENTS OF CIVIL, MECHANICAL AND ELECTRICAL ENGINEERING.

Full particulars of these Courses will be forwarded on application to the INTERNAL REGISTRAR. The Session COMMENCES on OCTOBER 2nd. 6674

Imperial College of Science AND TECHNOLOGY, LONDON, S.W. 7.

APPLICATIONS are INVITED for the POST of DEMONSTRATOR in the MATHEMATICS and MECHANICS DEPARTMENT of the ROYAL COLLEGE of SCIENCE (some Engineering Experience essential). Salary, £300 per annum. Full particulars on application.—Candidates' applications, addressed to the SECRETARY, at the College, must be received not later than 5th September, 1924. 6607

The Royal Technical College, GLASGOW.

DEPARTMENTS OF ENGINEERING.

MECHANICS AND MECHANICAL ENGINEERING:
Professor ALEXANDER L. MELLANBY, D.Sc., M.I. Mech. E.
Associate Professor WM. KERR, Ph.D., A.R.T.C.
ELECTRICAL ENGINEERING:
Professor STANLEY PARKER SMITH, D.Sc., M.I.E.E., A.M. Inst. C.E.
CIVIL ENGINEERING:
Professor GEORGE MONCUR, B.Sc., M. Inst. C.E., M. Amer. Soc. C.E.
MINING ENGINEERING:
Professor DANIEL BURNS, M. Inst. M.E.

Complete Courses of Instruction are provided, qualifying for the Diploma of the College (three sessions) and for the Degree of B.Sc. in Engineering of Glasgow University (four sessions). Composition Fee 25 guineas per annum.

Session 1924-25 begins on TUESDAY, SEPTEMBER 23rd.

Calendar, by post 3s., and prospectus, gratis, may be obtained on application to the DIRECTOR. 6566

Borough of Folkestone.

CONCRETE TUNNEL SEWER.

The Corporation is prepared to receive TENDERS for the CONSTRUCTION of about 280 Yards Lineal of CONCRETE SEWER, in Tunnel, size of sewer 5ft. high by 3ft. 6in. wide by 9in. thick concrete, together with all appurtenant works.

The plans may be seen and quantities and form of Tender obtained at the office of the Engineers, Messrs. W. H. Radford and Son, Albion Chambers, King-street, Nottingham, on deposit of Three Guineas (cheque), which will be returned on receipt of a bona fide Tender and the return of the quantities.

A copy of the plans may also be seen at the office of the Borough Engineer, A. K. Nichols, Esq., M. Inst. C.E., Borough Engineer's Office, Folkestone.

The lowest or any Tender will not necessarily be accepted.

Sealed Tenders to be delivered to the undersigned on or before Monday, September 1st, 1924, endorsed "Tunnel Sewer."

By Order,
A. K. KIDSON, Town Clerk.

Town Clerk's Office, Folkestone, Kent, August 18th, 1924. 6679

City of Liverpool.

WATER ENGINEER'S DEPARTMENT.

CONTRACTS FOR THE SUPPLY OF MATERIALS.

The Corporation are prepared to receive TENDERS covering the period of six months ending 31st March, 1925, for the SUPPLY of the undermentioned MATERIALS, viz.:—

1. BRASS CASTINGS and FITTINGS.
2. MISCELLANEOUS IRON PIPES and CASTINGS.
3. SLUICE VALVES.

Separate Tender forms, including specification and schedule, for any of the above items, will be forwarded upon receipt of application in writing to the Water Engineer, Alexandra Buildings, 55, Dale-street, Liverpool.

Duplicate forms of Tender for record purposes will not be supplied.

Tenders must be sealed and enclosed in the official envelopes provided, endorsed in accordance with the instructions in the form of Tender, and FORWARDED THROUGH THE POST, addressed to "The Town Clerk, Municipal Buildings, Liverpool," so as to be delivered not later than Ten o'clock a.m. on Tuesday, the 2nd September, 1924.

WALTER MOON, Town Clerk.

19th August, 1924. 6696

Broadstairs and St. Peter's URBAN DISTRICT COUNCIL.

SALE OF EXISTING WATERWORKS PUMPING PLANT.

The Council invite TENDERS for the PURCHASE and REMOVAL of the existing STEAM PUMPING PLANT at their Rumfields Pumping Station, comprising:—

A Compound Condensing Deep-well Pumping Engine.
Two Triple-expansion Worthington Pumping Engines.
A Loco. Type Semi-portable Boiler, by Ruston and Proctor.
A Lancashire Boiler, by Daver, Paxman and Co.
A Cornish Boiler, by Jas. Simpson and Co.
And other Incidental Plant and Fittings.

The removal is to be carried out in two instalments.

Further particulars, conditions and forms of Tender may be obtained from the Consulting Engineers Messrs. H. Rofe and Son, 208, Abbey House, Victoria-street, Westminster, S.W. 1. The plant may be viewed at any time by arrangement.

Tenders to be sent to the undersigned on or before Ten o'clock in the forenoon of Wednesday, the 27th inst.

The Council do not bind themselves to accept the highest or any Tender.

L. A. SKINNER, Clerk to the Council.

Pierremont Hall, Broadstairs, August 8th, 1924. 6684

Corporation of Madras.

SPECIAL WORKS DEPARTMENT.

DRAINAGE SECTION.

CONTRACTS M and M1, Nos. 46A and 47A.

PUMPING PLANT.

The Corporation of Madras, India, is prepared to receive TENDERS from competent persons willing to enter into a contract for the SUPPLY and DELIVERY of SEWAGE PUMPING MACHINERY, consisting of Oil Engines and Centrifugal Pumps, Pipes and Accessories, &c., to be provided, erected, set to work and maintained at North Mylapore and Lange Gardon Pumping Stations in the City of Madras, India.

Forms of Tender and contract in duplicate, with one set of drawings prepared by the Special Drainage Engineer to the Corporation, may be obtained from the undersigned, on payment of Ten Shillings for each contract, which will not be returned.

Tenders, accompanied by a deposit in currency notes or a draft on the Imperial Bank of India for Rs. 500, should be sent direct to the Commissioner, Corporation of Madras, so as to reach him not later than Twelve Noon on the 10th day of December, 1924.

The Corporation does not bind itself to accept the lowest or any Tender.

JAMES MANSERGH and SONS, Agents to the Corporation of Madras.

5, Victoria-street, London, S.W. 1. 21st August, 1924. 6717

County of London.

DISPOSAL OF TRAMCAR CONTROLLERS, MOTORS, &c.

The London County Council will have FOR DISPOSAL at the Tramways Car Shed, New Cross, or the Central Car Repair Depot, Charlton, approximately every four weeks during the next twelve months, certain EQUIPMENT, comprising Electric Car Controllers, Motors, Circuit Breakers, and Canopy Switches of the undermentioned types:—

CONTROLLERS—
Westinghouse, 90 M.
Dick, Kerr, D.B.I., Forms D. and G.
MOTORS—
Westinghouse 200.
Dick, Kerr 24 and 25A.
CIRCUIT BREAKERS—
Westinghouse, Style No. 5403.
Dick, Kerr, Type A, Forms B and C.
CANOPY SWITCHES—
Westinghouse, Style No. 5409.
Dick, Kerr, No. 2.

Persons, firms, tramways undertakings, &c., desirous of tendering for the purchase and removal of such equipment should apply to the Chief Officer of Stores, L.C.C. Stores Department, The County Hall, Westminster Bridge, S.E. 1.

Forms of Tender, containing full particulars, will be sent to applicants as the equipment becomes available.

JAMES BIRD, Clerk of the London County Council. 6688

Metropolitan Borough of ST. PANCRAS.

ELECTRICITY DEPARTMENT.

TENDERS are INVITED for the SUPPLY and FIXING of EXTRA HIGH-TENSION SWITCHGEAR. Specification and drawings can be obtained at the offices, 57, Pratt-street, N.W. 1, on the payment of £1, which is returnable on receipt of a bona fide Tender.

Tenders to be sent in on or before Tuesday, August 26th, 1924.

The Council do not bind themselves to accept the lowest or any Tender.

C. H. F. BARRETT, Town Clerk.

Town Hall, Pancras-road, N.W. 1. 6610

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PUBLIC NOTICES

For Sale by Tender.

BY ORDER OF MORTGAGEES AND RECEIVER FOR DEBENTURE HOLDERS.

Re Messrs. G. SCAMMELL and NEPHEW, Ltd., FASHION-STREET, SPITALFIELDS, LONDON, E. 1.

The Valuable and Extensive

FREEHOLD AND LEASEHOLD

LAND AND BUILDINGS,

situate and known as above, the whole site area extending to about 4713 SQUARE YARDS, together with the various FACTORY and GARAGE BUILDINGS, providing a floor area of about 70,000ft. Super. Also the

PLANT, MACHINERY, STORES and STOCK-IN-TRADE.

TENDERS are INVITED for the PURCHASE of :

(a) The FREEHOLD and LEASEHOLD LAND and BUILDINGS with all PLANT, MACHINERY, STOCK and STORES, on the basis of a Going Concern, together with the GOODWILL of the BUSINESS.

(b) The FREEHOLD and LEASEHOLD LAND and BUILDINGS, having a frontage of about 232ft. to the South Side of Fashion-street.

(c) The FREEHOLD LAND and BUILDINGS, having a frontage of about 185ft. 9in. to the North Side of Fashion-street.

(d) The PLANT, MACHINERY, STOCK and STORES.

The Works, Plant, &c., may be inspected between the hours of 10 a.m. and 4 p.m. from September 1st to September 6th, 1924, inclusive.

Particulars, plan and conditions of sale, together with all information, may be obtained from—

Messrs. BECKINGSALES and NAYLOES, Solicitors, 34, Copthall-avenue, E.C. 2 ;

Messrs. FRANKLIN, WILD and CO., Chartered Accountants, Orient House, New Broad-street, E.C. 2 ; or

Messrs. HENRY BUTCHER and CO., Auctioneers, Valuers and Surveyors, 63 and 64, Chancery-lane, W.C. 2. 6693

TO STEEL STRUCTURAL ENGINEERS.

Plymouth Corporation Water-WORKS.

BURRATOR RESERVOIR ENLARGEMENT. TEMPORARY BRIDGE.

The Water Committee invite TENDERS for the PROVISION of the necessary MATERIAL, ERECTION, TAKING DOWN and REMOVAL of a BRIDGE to be placed across the Burrator Reservoir, situated about 12 miles from Plymouth and about 11 miles from Dousland Station, G.W. Ry.

Form of Tender, specification and conditions may be obtained on application to the Water Engineer, Plymouth, accompanied by a deposit of Two Guineas, which will be refunded on receipt of a bona fide Tender.

Sealed Tenders, endorsed "Tender for Bridge," must be delivered to the undersigned not later than Monday, September 22nd, 1924.

The Committee do not bind themselves to accept the lowest or any Tender.

FRANK HOWARTH, M. Inst. C.E., Water Engineer.

Stonehouse Town Hall, Plymouth, August, 1924. 6685

Staines Union.

The Guardians of the above-named Union are desirous of receiving TENDERS for SUPPLYING and FIXING—

ONE 50-Gallon STEAM-JACKETED VEGETABLE BOILING PAN, with Cover and Draw-off Cock. Pan to be fitted with wire vegetable basket, capable of being lifted in and out of the pan by travelling pulley block.

ONE 20-Gallon WATER-JACKETED MILK BOILING PAN, with double bottom for steam and Draw-off Cock.

The Guardians do not bind themselves to accept the lowest or any Tender.

Further particulars can be obtained upon application to the Master, Poor Law Institution, London-road, Stanwell, any week-day between the hours of 12 noon and 4 p.m.

Tenders, endorsed "Tender for Coppers," to be sent to the undersigned through the post so as to be received not later than Twelve Noon, Saturday, 6th September, 1924.

R. A. HOGARTH, Clerk to the Guardians.

Clerk's Office, Stanwell-road, Ashford, Middlesex. 14.8.1924. 6646

The Madras and Southern

MAHRATTA RAILWAY COMPANY, LTD.

The Directors are prepared to receive TENDERS for

(i) TWO 4-WHEELED GOODS BRAKE VANS (I.R.C.A. Standard Type E. 1),
TWO BOGIE RAIL WAGONS (I.R.C.A. Standard Type BD. 1),
NINE 4-WHEELED EXPLOSIVES VANS (I.R.C.A. Standard Type X).
(BROAD GAUGE.)

(ii) SEVEN BOGIE CARRIAGE UNDERFRAMES (I.R.C.A. Standard Type),
THREE 4-WHEELED UNDERFRAMES,
NINE 4-WHEELED BRAKE VAN UNDERFRAMES (I.R.C.A. Standard Type ME/1).
(METER GAUGE),

in accordance with the specifications which may be seen at the offices of the Company. The charge for each of the specifications is One Guinea, which will not be returned. Tenders must be sent in, addressed to the SECRETARY, not later than 2 p.m. on Tuesday, 9th September, 1924, and marked "Tender for Underframes," or as the case may be.

The Directors do not bind themselves to accept the lowest or any Tender.

Company's Offices, 25, Buckingham Palace-road, Westminster, S.W. 1. 19th August, 1924. 6702

The Urban District Council of ROYTON.

STEAM PUMPING ENGINE FOR SALE.

The Council invite OFFERS for a HORIZONTAL DOUBLE-ACTING STEAM PUMPING ENGINE—steam cylinder 24in. diameter, water cylinder 16in. diameter, 48in. stroke—supplied by Samuel Walker, of Radcliffe, Lancashire, in 1899.

Disposal arises through a reconstruction of the Sewage Disposal Works, which will do away with the need for the engine.

The engine may be inspected any week-day during working hours at the works, Streethridge, Royton, and the specification can be seen at the Clerk's Office, Town Hall, Royton.

Offers must include for dismantling and removing the engine at the risk and responsibility of the successful tenderer. These should reach the undersigned by Monday, September 1st proximo.

ELLIS HARRISON, Clerk to the Council.

Town Hall, Royton. 14th August, 1924. 6661

The Commissioners for the Port OF CALCUTTA.

The Commissioners for the Port of Calcutta REQUIRE the SERVICES of TWO ASSISTANT SUPERINTENDENTS OF MACHINERY. Commencing salary Rs. 700 per month, rising by Rs. 50 per month each year to Rs. 1050, with a three years' agreement.

Well trained, mechanical engineers, capable of Supervising Marine, Railway, Hydraulic and Electrical Work are required. Candidates should have received a technical college training.

Applications, stating age, and accompanied by not less than two copies of testimonials, should be addressed to Mr. J. ANGUS, M. Inst. C.E., Consulting Engineer and London Agent, 10, Princes-street, S.W. 1. 6691

PUBLIC NOTICES

County of Durham.

APPOINTMENT OF COUNTY SURVEYOR, ENGINEER AND ARCHITECT.

The County Council of Durham are prepared to receive APPLICATIONS for the POSITION of COUNTY SURVEYOR, ENGINEER and ARCHITECT.

The person appointed will be required to devote the whole of his time to the duties of the office, and will not be permitted to undertake any other business. The salary will be at the rate of £1400 per annum, rising by annual increments of £100, subject to satisfactory service, to £1700 per annum.

The appointment will be subject to three calendar months' notice on either side.

Applicants must have special qualifications as to the Construction of Roads and Bridges, and preference will be given to those who are under the age of 45 and who are Corporate Members of the Institution of Civil Engineers.

The appointment is a designated post under the Local Government and Other Officers' Superannuation Act, 1922, which has been adopted by the County Council, and the person appointed will be subject to the provisions of such Act.

All offices, staff, stationery, &c., will be provided by the County Council.

Applications, endorsed "County Surveyor," together with copies of not less than three recent testimonials, to be sent to the undersigned, not later than Wednesday, the 17th September, 1924, from whom a statement of the duties and conditions of the office may be obtained.

Canvassing will be deemed a disqualification.

By Order, HAROLD JEVONS, Clerk of the County Council.

Shire Hall, Durham. 15th August, 1924. 6692

County Borough of Hudders-FIELD.

BOROUGH ENGINEER'S DEPARTMENT. APPOINTMENT OF DEPUTY BOROUGH ENGINEER AND SURVEYOR.

APPLICATIONS are INVITED from properly qualified persons for the OFFICE of DEPUTY BOROUGH ENGINEER and SURVEYOR.

Candidates must have had experience in the Surveying and Engineering Work of a Municipal Corporation, and have passed the Associate Membership Examination of the Institution of Civil Engineers or possess equivalent qualifications.

The inclusive salary is £450 per annum, and the appointment will be subject to one calendar month's notice on either side, expiring at the end of any month.

Applications on the prescribed form, to be obtained from the undersigned, are to be addressed to him at his office, 1, Peel-street, Huddersfield, endorsed "Deputy Borough Engineer," and delivered on or before Twelve o'clock Noon on Thursday, the 11th day of September, 1924.

Canvassing in any form is strictly prohibited, and will disqualify.

W. JAGGAR, Assoc. M. Inst. C.E., Chartered Civil Engineer, Borough Engineer and Surveyor.

Borough Engineer's Office, 1, Peel-street, Huddersfield. 20th August, 1924. 6714

H.E.H. The Nizam's Guaranteed STATE RAILWAYS.

JUNIOR ASSISTANT ENGINEER.

The Directors are prepared to receive APPLICATIONS (by letter only) from duly qualified candidates for APPOINTMENT to the above POST in India.

QUALIFICATIONS.—Candidates must have had a good general and technical education, and obtained a Degree at a recognised Engineering College or passed the Associate Membership Examination of the Institution of Civil Engineers. In addition, they must possess at least one year's practical experience with a railway company or on public works.

SALARY.—Up to Rs. 500 per calendar month to commence, according to age and experience.

TERMS.—A three years' agreement in the first instance, first-class free passage to India and home again on satisfactory termination of services. Privilege leave and furlough in accordance with the rules in force.

Applicants must send in to the undersigned a record of their career in chronological order (with dates), and COPIES ONLY of testimonials, service certificates, &c., giving name of firm where pupilage was served and of subsequent employers, with short details of work in each case, and with particulars of general and technical education, honours, &c., gained, not later than the 30th August, 1924.

F. ADAMS, Secretary.

Offices of the Company, 30, Old Broad-street, London, E.C. 2. 14th August, 1924. 6667

SITUATIONS OPEN

WANTED, CHIEF ENGINEER for Large Manufacturing Works in London ; must be thoroughly experienced in the Maintenance and Economic Running of an extensive Steam Generating, Electric Power and Milling Plant. Salary £800/£700. Applicants, whose age should not exceed 45 years, must give the fullest details of previous experience, with references.—Address, 6708, The Engineer Office. 6708 A

A NORTH of ENGLAND ENGINEERING FIRM has OPENINGS for TRAINING in their special business TWO YOUNG MEN with the idea of occupying positions at home or abroad. Applicants must have had a public school education, have been trained as engineers and must be between the ages of 21 and 26 years.—Address, stating particulars of education and training and initial salary required, 6647, The Engineer Office. 6647 A

AGRICULTURAL ENGINEERS COST CLERK REQUIRED for Eastern Counties. State qualifications and salary required.—Address, 6716, The Engineer Office. 6716 A

AIR COMPRESSORS.—Well-known MAKERS REQUIRE LIVE AGENT for Notts. and Derbyshire : practical engineer ; connection works and industrial concerns essential—Address, 6657, The Engineer Office. 6657 A

AIR COMPRESSORS.—Well-known MAKERS REQUIRE LIVE AGENT for Leicestershire, Lincolnshire, Rutland, Northants ; established connection with quarries and mines essential.—Address, 6658, The Engineer Office. 6658 A

AIR COMPRESSORS.—Well-known MAKERS REQUIRE LIVE AGENT for Devon and Cornwall ; established connection with quarries and mines essential.—Address, 6659, The Engineer Office. 6659 A

ARTESIAN WELL ENGINEERS, London, Old-established, REQUIRE experienced MAN as SUPERVISING FOREMAN on outside contracts ; must be experienced Percussion and Rotary Well Borer and thoroughly familiar with Air Lift, Mechanical and Electrical Pumping Installations, Pipe Laying, &c. Only first-class man considered.—Address, stating age, salary expected, and brief details of experience, 6599, The Engineer Office. 6599 A

COMMERCIAL ENGINEER WANTED in London district, with thorough knowledge of Design and Manufacture of Conveyors and Elevators ; must have personal connection amongst users. Excellent terms to suitable man. State age, experience and salary required.—Address, 6697, The Engineer Office. 6697 A

ENGINEERS, East London, Specialising Tanks, Cylinders, and Sheet Metal Work, REQUIRE GENERAL FOREMAN to Supervise Regular Output and Mark-off Special Work. Experience of Economical Production Methods, use of Modern Machine Tools, Estimating and Shop Organisation essential. Good prospects to capable man. State age, experience, salary required.—Address, 6680, The Engineer Office. 6680 A

ENGINEER SALESMAN REQUIRED, Age 28-32 ; Workshops and Sales Experience essential ; Chemical Knowledge an advantage. Full particulars and references, salary required.—Address, P9453, The Engineer Office. P9453 A

EXPERT PRESS TOOL MAKER REQUIRED for North-East Coast, to make Large Compound Dies for Electrical Stampings.—Address, giving full particulars of experience and wages required, 6662, The Engineer Office. 6662 A

MANAGER, Small Works, East Midlands, under 35, Public Works Agent might suit ; some electrical knowledge required ; 7 o'clock man. State age, experience, family, if disengaged, salary required, &c. —Address, P9468, The Engineer Office. P9468 A

THE MUNICIPALITY OF SINGAPORE, STRAITS SETTLEMENTS. SUPERINTENDENT OF FITTINGS, GAS DEPARTMENT.

The Municipal Commissioners of Singapore REQUIRE a SUPERINTENDENT OF FITTINGS for the GAS DEPARTMENT. Age about 25, well educated of sound constitution and unmarried. Candidates must have a good practical knowledge of Gas Fittings, Main and Service Laying, and General District Maintenance Work. The selected candidate must be of good education and address, as the Municipality lay on all services, together with internal fittings to private buildings, and the person appointed will come into contact daily with consumers in case of complaints or new fittings, &c., whose requirements he will be expected to satisfy. Preference will be given to an experienced canddate who has been employed as a District Inspector, and the duties are those usually carried out by a Superintendent of Fittings. The selected candidate would work directly under the instructions of an Assistant Gas Engineer in charge of district work. The appointment will be on agreement for three years, with possible extension. The selected candidate must pass a medical examination as to his fitness for service in Singapore. A passage will be provided with half-salary during the voyage out. The salary will be 4500 dollars for the first, 5040 dollars for the second, and 5520 dollars for the third year, paid monthly, the value of the dollar being two shillings and fourpence sterling. For the first year the salary would be equal to £552 as above, with an allowance for such transport as may be required on duty.—Applications, stating age and place of birth, and giving details of education, training and experience generally, stating when free, accompanied by copies (only) of testimonials, and also personal references, to be lodged with Messrs. C. C. LINDSAY and PEIRCE, MM. Inst. C.E., 180, Hope-street, Glasgow, Agents to the Municipal Commissioners (from whom further information may be obtained), not later than Tuesday, 2nd September, 1924. 6681 A

WANTED, an Experienced JUNIOR DRAUGHTSMAN, used to General Engineering Work ; knowledge of Internal Combustion Engines a recommendation.—Address age, experience and salary, 6695, The Engineer Office. 6695 A

WANTED by Large Firm of Steel Window Makers, TWO ESTIMATING DRAUGHTSMEN. Must be capable of extracting own quantities. Previous experience in this trade not essential, but preferred. Must be live, keen and ambitious.—Address in first instance, 6623, The Engineer Office, enclosing photograph, stating age, salary, experience, &c. All information treated in strictest confidence. 6623 A

WANTED, COMPETENT DRAUGHTSMAN to Take Charge of Drawing-office, for group of large collieries in South Wales ; salary £6 per week.—Address, 6673, The Engineer Office. 6673 A

CAPABLE DRAUGHTSMAN REQUIRED, Experienced in the Lay-out of Rolling Mills, Hydraulic Plant Design and Estimating ; must be quick and reliable ; prospects. State salary and when at liberty.—Address, 6703, The Engineer Office. 6703 A

CHIEF DRAUGHTSMAN REQD., London, with first-class exp. Boiler Design. £400 p.a.—Apply, LAURIE'S, Employment Specialists, 28, Basinghall-st., E.C. 2. No preliminary fee. 6704 A

CIVIL ENGINEERING DRAUGHTSMAN REQUIRED for Westminster, with experience of Industrial Buildings. State salary, &c.—Address, 6678, The Engineer Office. 6678 A

DRAUGHTSMAN WANTED for Engineering Works in Bombay, age not to exceed 30. Single man preferred. Must be proficient in constructural work. Five years' agreement.—Write, giving full particulars of career, to Z.Y. 247, c/o Deacon's, Leadenhall-street, E.C. 3. 6636 A

FIRST-CLASS STRUCTURAL DRAUGHTSMEN REQUIRED, for North-East Coast. Must have had experience on Heavy Bridge Work, Foundations, Buildings, &c.; designing, preparing drawings for shops and estimating. State salary required. Others need not apply.—Address, 6705, The Engineer Office. 6705 A

SENIOR STRUCTURAL DRAUGHTSMAN REQUIRED, Accustomed to Preparation of Design and Carrying-out of Work in accordance with L.C.C. and London Building Regulations.—Write, stating qualifications, experience and salary required, to Z.B. 314, c.o. Deacon's, Leadenhall-street, E.C. 3. 6701 A

TWO JUNIOR MECHANICAL ENGINEERS WANTED for Malaya, well educated and well trained, 21 to 25 years of age ; must have had good general shop and drawing-office as well as technical training ; one as draughtsman, capable of economically designing simple steel structures and machine parts, and preference would be given to another with knowledge of works estimating and rate fixing, and some commercial experience would be advantageous. Good prospects to steady, sober, reliable men with initiative. Progressive salary commencing £35 to £40 per month, according to qualifications. Full particulars of education and training, with copies of testimonials, Address, "MALAYA," Wm. Porteous and Co., Advertising Agents, Glasgow. P9433 A

SITUATIONS WANTED

ADVERTISER (29), 1st Class City and Guilds Final Mech. Eng., also National Cert for 3 yrs.' course mech. eng., 6 yrs.' workshop exp., SEEKS SIT. as JUNIOR DRAUGHTSMAN.—157, Sumatra-road, N.W. 6. P9472 B

A.M.I.C.E. (32), on Leave from Far East, REQUIRES progressive POST at home. Last 3½ years Eastern representative for a prominent firm of civil engineers and contractors.—Address, P9426, The Engineer Office. P9426 B

BOILING WATER EXPERT (Gas or Steam) DESIRES PROGRESSIVE POSITION with firm or CAPITAL to Develop Improved Counter Boilers for making tea and coffee.—Address, P9467, The Engineer Office. P9467 B

CIVIL ENGINEER, Age 30, B.A. (Cambridge), Experienced light and heavy railway construction, North and South America, good horseman, fluent Spanish, DESIRES POSITION ABROAD.—Address, P9454, The Engineer Office. P9454 B

COLONIES OR ABROAD.—ELECTRICAL ENGINEER, at present electrical manager to a large industrial concern at home, WANTS POSITION with sound concern in Colonies or abroad. Age 38, married ; sound organiser, accustomed to run a large electrical system, to control a large staff, and to deal with the whole range of work. Capable of forming and following out a definite policy. Energetic and keen. Trained in shops and D.O. ; academic qualifications, Chartered Civil Engineer.—Address, P9471, The Engineer Office. P9471 B

ENGINEER (28), College Trained, Experienced Steel work and oil tank erection, shop management, drawing-office, fluent French and Portuguese, SEEKS EMPLOYMENT, Drawing-office or outside ; home or abroad.—Address, P9475, The Engineer Office. P9475 B

SITUATIONS WANTED (continued)

ENGINEER, Practical, Commercial, Inspecting and on-going experience, at present engaged, DESIRES CHANGE ; any capacity, but executive position preferred.—Address replies, with appointment, to P9473, The Engineer Office. P9473 B

ENGINEER (30) REQUIRES PERMANENCY, Assistant or Charge Factory Plant ; all-round pre-war experience, 2½ years marine.—Address, P9483, The Engineer Office. P9483 B

EXPERIENCED MECHANICAL and ELECTRICAL ENGINEER, with sound knowledge of inorganic chemistry, DESIRES POST ; good designer.—Address, P9456, The Engineer Office. P9456 B

FULLY QUALIFIED ENGINEER, Opening Offices in Lancashire, is OPEN to UNDERTAKE INSPECTION WORK, steam, internal combustion, machinery or allied trades, or would Represent a reputable Firm.—Address, P9480, The Engineer Office. P9480 B

G.I. MECH. E. (22), 5 Years Well-known Marine engineers and shipbuilders, experience with steam, gas and oil engines, water-tube boilers, DESIRES POST with prospects, home or abroad.—Address, P9459, The Engineer Office. P9459 B

HONOURS GRADUATE in ENGINEERING, with no previous practical experience, DESIRES a BEGINNING with firm of Structural Engineers.—Address, P9461, The Engineer Office. P9461 B

LADY SHORTHAND TYPIST DESIRES SECRETARIAL POSITION, Westminster or South-West preferably ; 10 years' engineering experience, 14 total ; excellent testimonials ; salary £4 weekly.—Address, P9477, The Engineer Office. P9477 B

POSITION on Commercial or Technical Side.—MECHANICAL ENGINEER (37), A.M.I.M.E., 5 years technical, 5 years shops in England, 5½ years shops America, 3 years commercial China ; prefer London, but would go abroad ; machine tools and general engineering.—Address, P9469, The Engineer Office. P9469 B

PRODUCTION ENGINEER SEEKS POST. Sound methods in rate-fixing and processing ; accept any reasonable salary.—Address, P9478, The Engineer Office. P9478 B

SHEETERS WANT SHEETING WORK. Long job and piece-work preferred.—Address, R. FORREST, 40, Mortimer-street, Blackhill, Co. Durham. P9485 B

SOLE AGENTS of Important Steel Rolling Mills (Belgian) DESIRE to APPOINT influential SUB-AGENTS on commission basis in Glasgow, Birmingham, Manchester, Cardiff. Established connections among buyers of steel essential.—Address, P9466, The Engineer Office. P9466 B

YOUNG CIVIL ENGINEER, B.Sc. (Lond.), University, articles and engagement with large Port Authority, DESIRES CHANGE, with good experience, at home or abroad. Experienced in steel and R.C. design and supervision, warehousing and wharves, hydraulic, river, canal and harbour work all classes of surveying. Excellent references.—Address, P9458, The Engineer Office. P9458 B

YOUNG ENGINEER (24), B.Sc. (Civil Engineering), 3 years' office and works experience, DESIRES POST, preferably with firm of Reinforced Concrete Engineers.—Address, P9484, The Engineer Office. P9484 B

CHIEF DRAUGHTSMAN and ENGINEER, ESTIMATOR and EXPERT CALCULATOR, with 15 yrs.' experience, DESIRES CHANGE ; first-class theoretical training, excellent works and D.O. experience in general engineering, including welded and riveted work, steam and I.C. engines, structural and building design, plant lay-out, electrical work ; fully accustomed to direct works and office. Position required where energy, ability and hard work will bring advancement.—Address communications, P9481, The Engineer Office. P9481 B

DRAUGHTSMAN and DESIGNER, Heating and Ventilating Engineers, experienced in vent. refuse, dust and fume extraction and kindred specialities ; moderate salary.—Address, P9470, The Engineer Office. P9470 B

DRAUGHTSMAN, with Sound General Engineering experience, WOULD LIKE TO SPECIALISE ; 6½ years present position (steel works), student of I.C.S. Engineering Course ; excellent refs.; willing to go anywhere.—Address, P9460, The Engineer Office. P9460 B

ENGINEER'S DRAUGHTSMAN, 5 Years' Experience in design and detail of concrete mixers, concrete hoisting and placing equipments and contractors' plants, &c.; age 24 years.—Address, P9462, The Engineer Office. P9462 B

EXPERIENCED FOREMAN, Machine Shop or Works, DESIRES POSITION ; good references.—G. B., 13, Blinco-road, Peterborough. P9487 B

PRESS and MACHINE TOOL MAKER and SETTER (25) SEEKS RES. POSITION ; 10 yrs.' exp., up-to-date knl. design of machines, press and mach. tools, jigs, &c., for expeditious prod.—F. GRUBERT, Stonemasta, Barton-on-Humber. P9482B

EDUCATIONAL

A.M.I.C.E., A.M.I.M.E., B.Sc., AND ALL ENGINEERING EXAMINATIONS.—All my students have my personal attention. Thousands of successes during the past nineteen years. Course can be commenced at any time. Please note change of address.—O. P. KNOWLES, M.S.E., B.Sc., A.M.I.C.E., &c., Parliament Mansions, Victoria-street, Westminster, S.W. 1. Ex. B

CORRESPONDENCE COURSES for Inst. C.E., Inst. Mech. E., London Univ. (Matric., Inter., and B.Sc.), personally conducted by Mr. TREVOR W. PHILLIPS, B.Sc. (Honours), Assoc. M. Inst. C.E., M.S.I., F.R.S.A., &c. Also Day Tuition in Office. Excellent results at all Exams. Courses may commence at any time.—8/11, Trafford Chambers, 58, South John-street, LIVERPOOL. Ex. E

PITMAN'S CORRESPONDENCE COURSE in ENGINEERING DRAWING.—To succeed in any branch of Engineering—Civil, Mechanical, Electrical, Hydraulic, Textile, or Motor Engineering, &c.—you must be able to make a WORKING DRAWING. My special postal course in mechanical drawing and machine design teaches you the latest and most modern drawing-office practice. Students and workmen employed in the day-time advance rapidly under my interesting and practical system of teaching by post. If you have ambition and desire a more congenial and lucrative occupation let me help you. Enrol now for the complete course. Fee three guineas (or by instalments). Also day and evening tuition in office. Established in 1894. P. PITMAN, M.I. Mech. E., 25, Victoria-street, London, S.W. 1. 6563 B

SURVEYING AND LEVELLING.—EXCELLENT OPPORTUNITY to ACQUIRE thorough practical INSTRUCTION on WORK.—Address, E. MOUL, Hollybank, Woking. P9332 B

MACHINERY, &c., WANTED

SECOND-HAND HYDRAULIC PRESS WANTED, Four Pister, pressure about 50 tons.—Full particulars to G. A. HARVEY and CO. (London), Ltd., London, S.E. 7. 6611 F

For continuation of Small Advertisements see page 3.

A Seven-Day Journal

The Mauretania's New Record.

The expectation that the Mauretania would set up a new speed record after the reconditioning of her turbine machinery has been fully realised, and the newly made record of last week must be a considerable source of satisfaction to the Cunard Company and to John I. Thornycroft and Co., Southampton, who carried out the machinery overhaul. Leaving Cherbourg Breakwater at 6.45 p.m. on Saturday evening, the 9th inst., the Mauretania arrived at the Ambrose Channel Lightship at 5.5 p.m. on the following Thursday evening, making the passage of 3157 miles in 5 days 3 hours and 20 minutes, at an average speed of 25.60 knots. The only approach to this speed was the vessel's own voyage in June, 1922, when, also on a west-bound south course, she steamed 3197 miles in 5 days 9¼ hours, at an average speed of 24.68 knots. From these figures it will be seen that she has beaten her previous steaming record on the Cherbourg–New York run by nearly 6 hours. The complete voyage last week was made in 5 days 7 hours and 20 minutes, and the passengers were landed at the dock on the Thursday evening. Throughout the trip good weather was experienced, but it is reported that Captain Rostron stated that the current of the Gulf Stream held the ship back in amount varying from half to over one knot. The Mauretania has once more proved that she is the world's fastest liner, and holder of the Blue Ribbon of the Atlantic.

A New Bridge at Tilbury.

A new bridge is to be built at Tilbury Station, which will make possible the reconstruction of that station, which has already been planned in connection with the new passenger landing stage, to be built under the Port of London Authority's scheme. The contract for the new bridge has, we learn, been placed by the London, Midland and Scottish Railway with Sir William Arrol and Co., Limited, of London and Glasgow. The new structure is to take the form of a bridge carrying the Ferry-road across the railway near the Tilbury Station, and it will include three viaduct approaches. Altogether forty-five spans, the smallest of which is 22ft., while most of them are 90ft. to 100ft., will be built. The work will involve, we understand, a considerable amount of excavation and piling, and the bridge foundations are to be constructed in reinforced concrete. On the concrete foundations a steel and brick bridge will be erected, and it is estimated that the steelwork alone will involve some 1280 tons of material. The completion of the new Ferry-road bridge at Tilbury should prove an important step in the extensive improvements which are to be undertaken by the railway and port authorities.

Salving H.M.S. Lutine.

Interest in the history of the wreck of H.M.S. Lutine has again been aroused by the announcement in a recent issue of *Lloyd's List and Shipping Gazette* that a contract has been signed between Lloyd's and two Dutch engineers of Delft, whereby salvage operations on the wreck are again to be undertaken for a specified period with the hope of recovering cargo and other objects. The salvors, it is stated, will use apparatus of their own design, and a ship is now being fitted out and operations are expected to begin as soon as the weather permits. H.M.S. Lutine was lost in a heavy gale on the night of October 9th, 1799, in the shallows of Terschelling and Vlieland. The ship was carrying at the time a considerable amount of money, which was insured by Lloyd's underwriters, who promptly settled a total loss. Between 1799 and 1821 over £55,000 in gold and silver bullion was recovered from the wreck by boatmen and fishermen, half of which sum was paid to the Dutch Government. In 1821 Mr. Pierre Eschanzier obtained exclusive rights of salvage, but little success attended the operations, and the Dutch Government subsequently agreed to cede to Lloyd's that Government's moiety of any recovered treasure. Since that time many agreements have been entered into with Lloyd's with extremely disappointing results. It remains to be seen whether the present scheme will be more successful. Meanwhile, Lloyd's remains closely connected with the fortunes of the ill-fated ship, for the famous Lutine bell is always rung at Lloyd's prior to announcing news of an overdue ship.

The Morden Underground Extension.

Work has now been begun on the extensions of the City and South London Railway from Clapham to Morden. The new line follows the general direction of the main Epsom road, and will have a length of 5½ miles. It will be necessary to drive over 4½ miles of tunnels, and tunnelling work on the Clapham–Tooting section will be carried out by Charles Brand and Son, while that on the section between Tooting-broadway Station and Dorset-road, Morden, will be completed by the Foundation Company, Limited. A short distance south of the Grove at Morden the line emerges into the open and continues in the open until the terminus near the Crown Inn is reached. Seven new stations—at Nightingale-road, Balham, Trinity-road, Tooting-broadway, Collier's Wood, South Wimbledon, and Morden—are to be built, and all except Morden, which is on the ground level, will be equipped with escalators. The work will be carried on simultaneously from seven points, and will proceed day and night. It is expected that the tunnelling will be driven at the rate of about 100ft. of double tunnel per week, from each headway, giving a total of about 1400ft. of tunnel per week. Over 60,000 tons of cast iron segments are to be used for lining the tunnel. It is expected that the new line will be opened for traffic at the end of next year.

Electricity Supply in Glasgow.

The report of the Glasgow Corporation Electricity Department for the year ending May 31st shows that, while the consumption of electricity in the city increased, during the period which the report covers, the surplus transfer to the credit of the reserve fund account is considerably less than that for the previous year. Working expenditure during the year amounted to £571,118, interest on loans and payments to the sinking fund to £482,980, and a sum of £93,120 was written off for depreciation. All these charges were considerably more last year than they were in 1922–23, so that while the gross revenue of £1,153,194 was £119,592 more than it was in the previous year, the surplus for last year of £5974 was much less than the preceding surplus, which amounted to £9507. The amount of electricity sold, namely, over 162 million Board of Trade units, was 17 per cent. more than that sold during the previous year, whilst between May 31st, 1923, and May 31st, 1924, the number of consumers increased from 54,590 to 58,390.

The Loth Cable System for Aeroplanes.

In addition to the proposals to equip French Channel ports with the Loth cable system, which enables vessels equipped with the necessary apparatus to guide themselves electrically by means of a submarine cable, it has been decided to equip the Paris–London airway with the system, so that in foggy and cloudy weather there will be no danger of aeroplanes straying from the direct route. A large number of French aeroplanes are to be equipped with the Loth apparatus. An overhead cable is to be provided between Paris and Boulogne and a submarine cable between Boulogne and the English coast. It is hoped that the first section of the line will be ready for use next May, for the difficulties which originally stood in the way of the scheme have been removed. Originally, the peasants across whose land the overhead line is to run protested and asked that the cable should follow the road. Such an arrangement would, however, have rendered the cable useless, as the route must of necessity follow a straight line. Finally, a decree of expropriation was passed, and nothing now stands in the way of the work being commenced.

The Hendon-Edgware Railway Extension.

The opening for public traffic on Monday last of the London Electric Railway Company's extension of its Golder's Green line from Hendon to Edgware reminds us that the latter place has been for nearly sixty years without any other railway communication than that provided by the branch off the Great Northern main line, which was opened on September 22nd, 1867. Thirty years later—on August 6th, 1897—powers were given to the Watford, Edgware and London Railway Company to connect the above branch with the Rickmansworth branch of the London and North-Western at Watford. The construction of the Charing Cross, Euston and Hampstead—sanctioned in 1893—suggested that Edgware should be joined to that line and the Edgware and Hampstead Railway Company obtained powers for this in 1902. These powers were, in 1906, transferred to the Watford and Edgware Company, which in 1909 obtained an extension of time. In 1912 a further extension was necessary, and this was granted, and by the same Act the powers were transferred to the London Electric Railways. The authority for building the line between Watford and Edgware expired in 1911.

A Floating Base for Airships.

Initial trials which appear to have been very satisfactory were carried out recently with the mooring mast for airships, erected on board the Patoka, an oil tanker belonging to the United States Navy. Leaving its shed at Lakehurst, N.J., the large dirigible Shenandoah, proceeded to Narragansett Bay, Rhode Island, where the Patoka was lying. Within an hour the airship was secured to the mast, the operation being carried out with less trouble than had been anticipated. The mast is a steel tower placed well at the stern of the ship and rising about 100ft. above the deck. Moored to this structure by the nose, the dirigible is free to ride the air and swing in any direction with the wind. In addition to the mooring mast, the Patoka is equipped for replenishing the airship with helium, of which 250,000 cubic feet are carried on board. This gas is conveyed from the flasks through a 12in. pipe leading to the top of the mast, where it is connected up with the main intake valve of the airship. While the Shenandoah has a gas capacity of 2,225,000 cubic feet, it is normally inflated with 1,800,000 cubic feet, which has been found ample for ordinary cruising. As the leakage is very small, it is believed that the reserve of helium stored on board the Patoka would suffice to keep the airship adequately supplied for a long period. The mooring mast was designed in connection with the Shenandoah's proposed flight to the Arctic regions, which was subsequently abandoned. A second large American airship, the ZR 3, has been building for some considerable time at the Zeppelin works in Friedrichshafen, Germany. This dirigible was to have essayed the Atlantic flight last spring, but for some reason its completion has been delayed, and a message despatched on August 7th stated that the installation of new Maybach motors was then about to be undertaken.

Quarry Development in Devon.

Arrangements have just been completed, and confirmed by the Ministry of Transport, for the construction of a light railway, which should help considerably in the development of the granite quarrying industry of Devon. The railway in question will be constructed on Hingstown Down, and will connect the granite quarries with the Southern Railway Company's branch line from Callington to Bere Alston. The stone is said to be of the finest quality, and extends over an area of some 50 acres. It will be quarried primarily as road metal and for setts. The quarries are to be equipped with modern machinery, and it is hoped that the industry will develop rapidly. This scheme is specially noteworthy on account of the fact that it has been decided to expend about a million sterling on the reconstruction of the main trunk roads in Devon, a work which is to be started within the next few weeks.

Shipping the World's Largest Turbine.

A new record in the dispatch of large electrical machinery has been created by the shipment of the 50,000-kilowatt turbo-alternator—the world's largest steam turbine generating plant—which has been built by C. A. Parsons and Co., Limited, of Newcastle, for the Commonwealth Edison Company's power station at Crawford-avenue Chicago. By the end of last week the huge plant had been dismantled and packed in sections ready for removal by rail to the wharf of the North-Eastern Marine Engineering Company, Limited, at Wallsend, where the steamship Cairntorr was berthed. As some of the largest sections of the turbine were considerably wider than the maximum rail gauge, it was necessary to close the London and North-Eastern Railway Company's line on Sunday last to all other traffic while the material was transferred to the ship. One portion of the exhaust branch measured 21ft. by 14ft., and the largest lift was the 78-ton alternator stator which was carried on a six-axle wagon. Altogether there were some 200 separate packages with a total weight of over 1000 tons. On arrival at Montreal, the machinery will be transferred from the Cairntorr to lighter craft, and will be shipped by the Welland Canal route to Chicago. Messrs. Parsons are sending their own staff with the machinery, and the shipment is being carried out by G. W. Sheldon and Co., Limited, of London and Chicago. The entire work on the contract occupied over eighteen months, and represents, it is said, a cost of £150,000. The construction and transhipment of this plant to America may rightly be regarded as an outstanding event in the history of British engineering industry.

The Proposed St. Paul's Bridge.

By referring the consideration of the scheme for the construction of a bridge across the Thames in the neighbourhood of St. Paul's Cathedral to the Royal Fine Art Commission, the Government has done something towards increasing the weight of opinion against the proposal. The Commission, composed almost wholly of architects and artists, and with no engineer among its members, has reported strongly against the carrying out of the scheme on the ground that the proposed bridge would be a disappointment from the æsthetic standpoint and that its construction would imperil the Cathedral to an extent that might, in the already weakened state of the fabric, produce a catastrophe. The Commission refers to the existing perilous thrust of the dome on the piers, and expresses its grave apprehension as to the effect of increased vibration. Meanwhile traffic continues to creep gingerly across Waterloo Bridge, which has been bolstered up to serve until the temporary bridge is ready. Higher up Westminster Bridge is giving cause if not for anxiety at least for some consideration. It is announced that next Tuesday afternoon it will be closed for a period of 15 minutes in order that tests may be made of the effect on the structure of the increased weight and speed of the traffic using it. Observations are to be made when the bridge is free of load preceded and followed by similar observations when it is fully loaded.

The British Empire Exhibition.

ENGINEERING EXHIBITS, No. XVIII.*

TEXTILE MACHINERY IN THE PALACE OF INDUSTRY.

A COMPLETE COTTON MILL.

THERE are many evidences at the British Empire Exhibition of the growing popularity of collective exhibits, both in the home and overseas sections. The primary cause is no doubt the very high cost to the individual exhibitor of making an adequate display. But certain competitive firms have discovered that there is much more than a mere saving of cost in a collective exhibit if it be properly worked and if the firms concerned can for the time being sink their

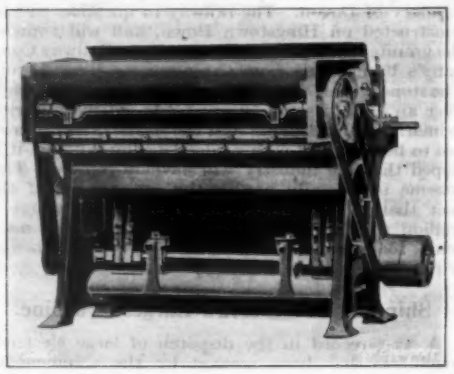


FIG. 344—MACARTHY COTTON GIN—PLATT BROS.

competitive prejudices and agree as to what each shall show in the formation of a complete exhibition factory which will represent the industry as a whole.

The most striking and comprehensive of these collective machinery exhibits at Wembley is the complete cotton mill which can be seen in operation for several hours every day in the Palace of Industry. This factory, which is a *real* factory and not merely a demonstration of machines in movement, shows the whole of the processes of cotton and cotton fabric production from the time when the raw seed cotton is ginned to the weaving, folding and measuring of the finished fabric.

This textile mill is the combined work of no less than twenty-eight competing makers of textile machinery, ten of which between them bring the process up to the production of the finished thread, while the others, which are makers of looms and accessories, show us how mechanical weaving is carried out in different ways by the most up-to-date of looms.

The spirit of co-operation between industrial competitors has been carried out to such an extreme degree that actually in some cases two or more firms have collaborated in the production of one machine. Thus, although the body of a loom is by one firm, the "dobby," which in a measure may be called the "brain of the loom," is the work of another, whereas both of the firms are makers on their own account of looms and dobbies. Then again, a firm which is known as a maker of winders or scutchers may not be showing anything of the sort, but may be exhibiting gins or carding engines and *vice versâ*. When such is the case it seems invidious in reviewing this splendid display to differentiate too closely between the products of the various firms which have combined to make it. We give, therefore, in alphabetical order the names of the twenty-eight firms concerned :—

Arundel, Coulthard and Co., Limited, Stockport.
Elijah Ashworth, Limited, Manchester.
Atherton Bros., Limited, Preston.
Blackburn Loom and Weaving Machinery Manufacturing Company, Limited, Blackburn.
Brooks and Doxey (1920), Limited, Manchester.
Cooper Bros., Limited, Burnley.
Wm. Dickinson and Sons, Limited, Blackburn.
Dobson and Barlow, Limited, Bolton.
Goodbrand and Co., Limited, Stalybridge.
Gregson and Monk, Limited, Preston.
Hacking and Co., Limited, Bury.
J. Hetherington and Sons, Limited, Manchester.
James Hill and Son, Keighley.
George Hodgson, Limited, Bradford.
Asa Lees and Co., Limited, Oldham.
Henry Livesey, Limited, Blackburn.
Lupton and Place, Limited, Burnley.
Pemberton and Sons, Limited, Burnley.
J. Pilling and Sons, Limited, Colne.
Platt Bros. and Co., Limited, Oldham.
Richardson, Tuer and Co., Limited, Farnworth, near Bolton.
D. Sowdon and Sons, Limited, Shipley.
Joseph Stubbs, Limited, Manchester.
Wm. Tatham, Limited, Rochdale.
Ward Bros. (Blackburn), Limited, Blackburn.
W. B. White and Sons, Limited, Colne.
Willan and Mills, Blackburn.
Wilson and Co., Limited, Burnley.

We propose to follow the process right through from the ginning of the raw cotton, but before doing so we should explain that the great value of this exhibit as a whole does not consist in any striking or revolutionary inventions which have affected the general principles of production, but in the fact that it shows the very latest and most recently elaborated designs of the Empire's textile machinery for carrying out those principles as rapidly, easily, and efficiently as possible.

This model cotton mill contains some fifty machines and occupies an area of 13,750 square feet in the "Cotton Section" organised by various associations connected with the trade. The area is comprised in two adjoining sections divided by a gangway, in the smaller of which are carried out all the coarser operations (if one may describe as such any of the processes connected with the automatic handling of these very delicate fibres), notably the ginning and opening of the cotton.

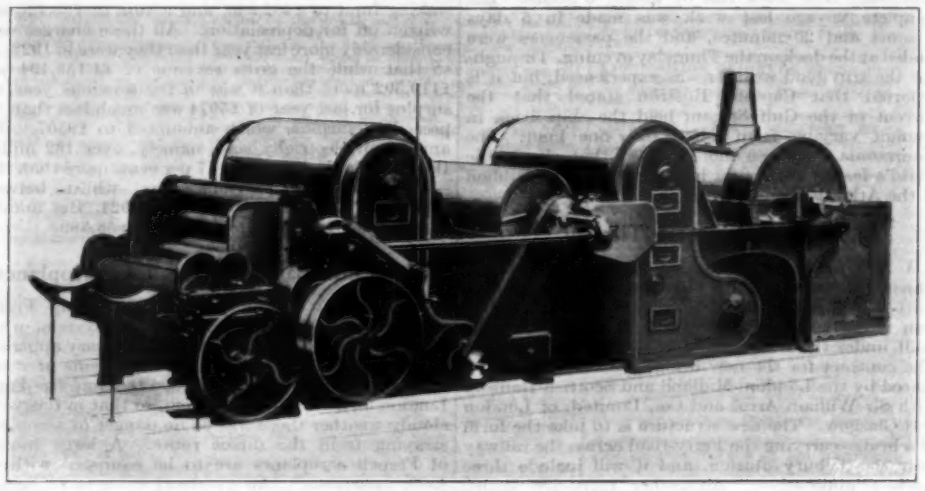


FIG. 347—PLATT AND WILKINSON LATTICE FEEDING MACHINE—PLATT BROS.

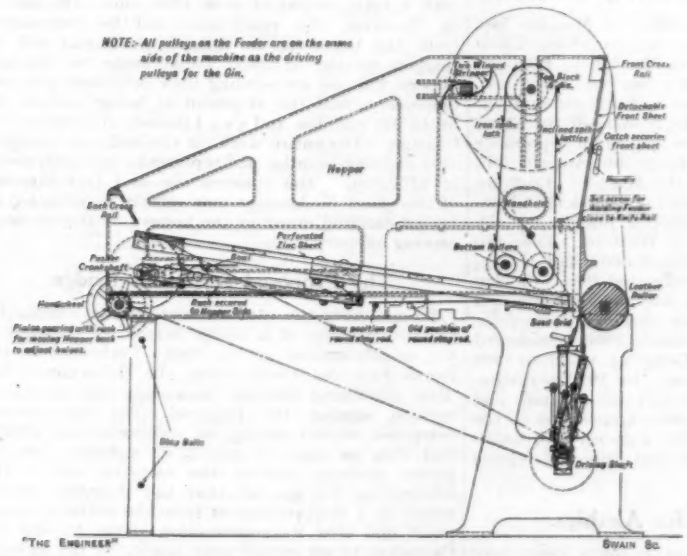

NOTE:- All pulleys on the Feeder are on the same side of the machine as the driving pulleys for the Gin.
Hopper
Perforated Zinc Sheet
Bottom Rollers
Leather Roller
Saw Grid
Driving Shaft
"THE ENGINEER"
SWAIN Sc.

FIG. 345—DOUBLE-ACTION COTTON GIN SHOWING HOPPER FEED—PLATT BROS.

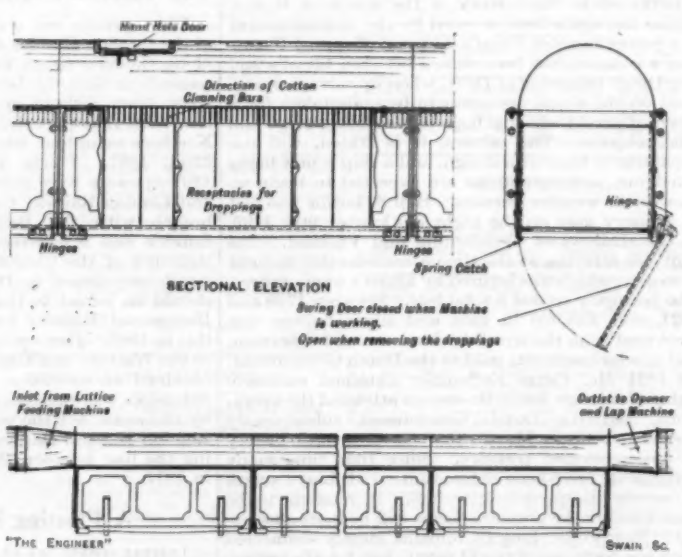


FIG. 346—STATIONARY GRID DUST TRUNK—PLATT BROS.

THE COTTON GINS.

The machines exhibited for these purposes are all made by Platt Bros. and Co., Limited, of Oldham. In them the seeds are removed from the surrounding cotton by one or another of five gins, three of which are on the well-known "Macarthy" (hide roller and comb) principle, essential for dealing with the longer fibred cottons, and two are of the more brutal saw type for such fibres as are sufficiently short to be able to escape destruction by the saw blades. Of the Macarthy

* No. XVII. appeared August 15th, 1924.

gins one is a hand gin and the others are single and double-action power-driven machines respectively. The last-named is illustrated by Fig. 344. In the power-driven machines a recently patented improvement is an automatic hopper feeder which permits a single attendant to keep ten gins supplied continually. Another feature is a spiked lattice which lifts the material from the hopper in such a manner as to distribute it evenly along the roller, automatically returning any surplus seed cotton to the hopper for re-passing.

The feeder, which we illustrate by Fig. 345, is in effect a large hopper, inside which is a vibrating feed table and an inclined elevating spiked lattice extending to the bottom of the hopper. A stripping roller at the upper end of the elevating lattice, ensures that only a sufficiency of seed cotton is delivered to the ginning roller at a time, thus automatically regulating the uniformity of the supply.

The cotton in the hopper is advanced by the action of the feed table against the spikes of the elevating lattice, which carries it upwards past the stripper and then down to the moving knives or knife. Here it is subjected to the usual ginning action of the machine, any surplus seed cotton that may have been delivered being taken back to the hopper by means of the spiked lattice. This is obviously an important feature, as, while the feed is automatic, there is no possibility of choking the gin by overcharging it, for as long as the hopper is kept supplied with seed cotton the action of feeding and ginning must be continuous and regular. It is claimed that this improved feeder and the uniformity in supply occasioned by it have had the effect of increasing the output of these gins by about 50 per cent.

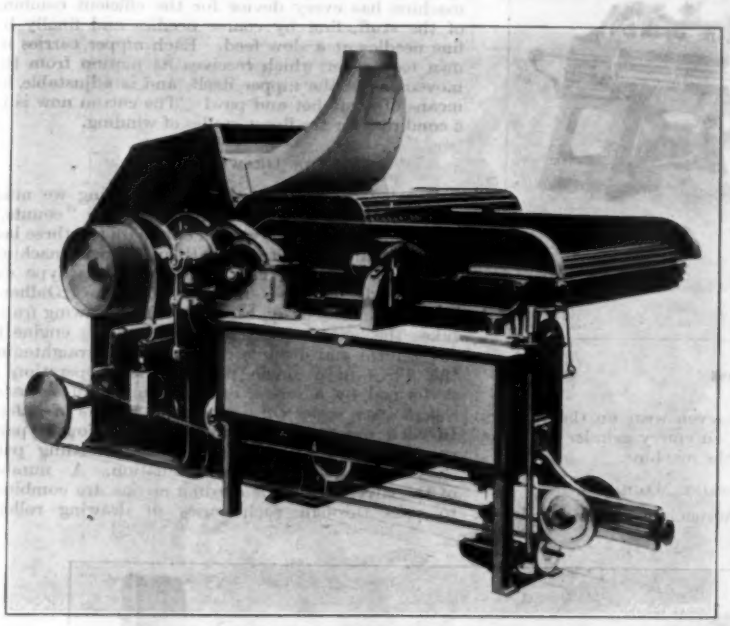


FIG. 349—OPENER LAP MACHINE—PLATT BROS.

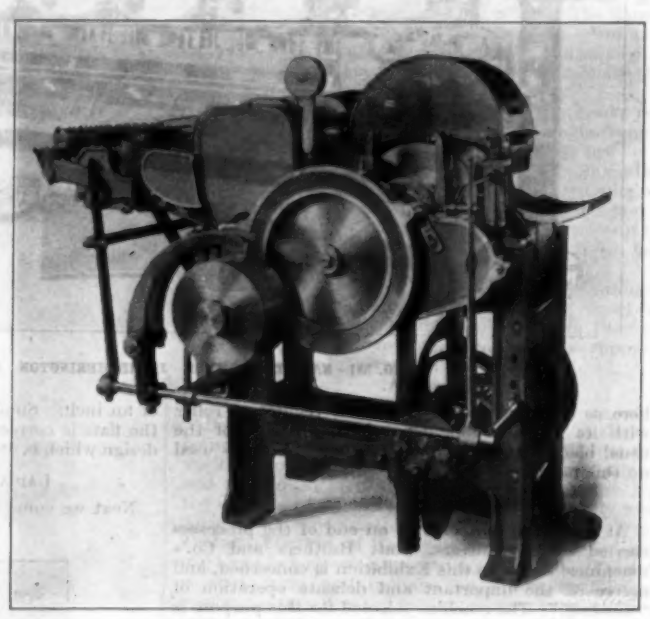


FIG. 349—SLIVER LAP MACHINE—J. HETHERINGTON AND SONS

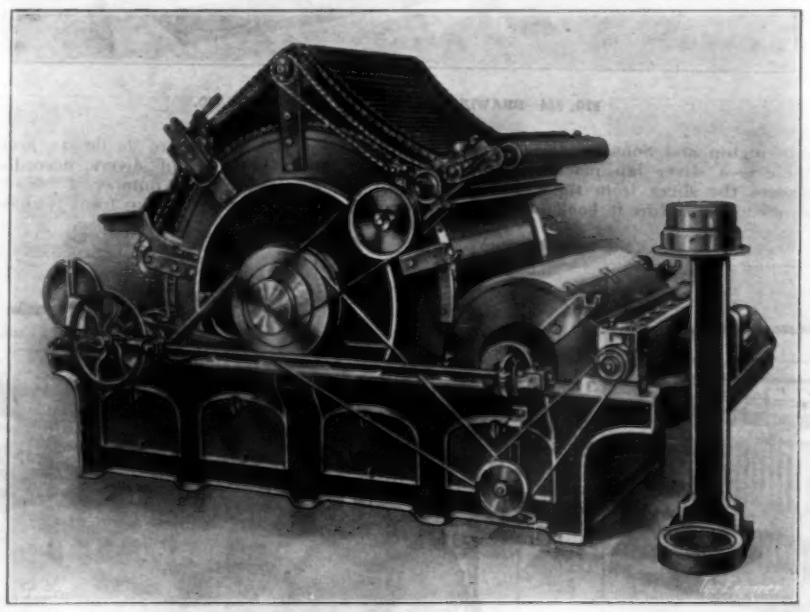


FIG. 350—NON-FLEXIBLE BEND REVOLVING FLAT CARDING ENGINE—ELIJAH ASHWORTH

Breaking and Opening.

The process of ginning naturally takes place in the countries where the cotton is grown, and where also it is packed in bales and sent to market. It is at this point that the machines take up the work again, and the first of them is the hopper bale breaker which receives the compressed and matted fibre direct from the bale, which may contain a considerable amount of foreign matter, such as dust, broken seeds, leaves and twigs, and opens it up by a coarse combing action.

A horizontal lattice receives the stuff from the hopper, carries it forward and presses it against the spikes of an inclined elevating lattice, where it is combed and, as it pursues its upward course, comes to a spiked roller which combs it a second time. The spiked roller, which is automatically cleaned by a stripping roller, returns all unopened pieces back to the hopper for re-passing, while the properly combed material is stripped from the lattice by a beater and falls on to a grid which carries it forward for the next process.

The hopper bale breaker takes, indiscriminately, any fibre that may be submitted to it, and it is here that the blending of the various grades or "marks" of fibres is done, if required.

From the bale breaker the cotton passes to a Platt and Wilkinson patented hopper opener. The function of this machine is to synchronise the delivery of the cotton from the bale breaker to the hopper feeder. This is done automatically by means of an ingenious device of weighted and balanced swing doors, which are connected by a rod with the striking gear on the bale breaker. In this machine further combing is done by strong spiked lifting and evener lattices.

The introduction of this machine between the bale breaker and the feeder improves the quality and the output without occupying any more floor space than did the old-fashioned inclined lattice which formerly connected those two machines. From the opener the cotton passes to the automatic hopper feeding machine with its evener lattice and filling apparatus of which the construction is well known.

A very interesting machine, however, is the Platt and Wilkinson patented lattice feeding machine, shown in Fig. 347—which can be used in connection with various opening and cleaning machines. The effect of this machine is twofold—it increases the cleaning power without additional beating, which is of very great advantage, and it ensures an even sheet of lap cotton. This machine is fitted with a 24in. diameter cylinder, with strong combing blades, and the grid bars, instead of extending for about one-quarter of the way round the circumference of the cylinder, envelop it for about three-quarters of the circumference. These grid bars are arranged at two separate angles, thus allowing of the easy escape of small refuse through the spaces without losing any of the good fibres.

Further cleaning is effected by a Crighton opener, into which the cotton is fed at the bottom of the cylinder, and carried upwards by the suction of a fan, aided by the construction and speed of the cylinder, leaving behind most of the heavier impurities. When a very clean class of cotton is being used, this machine can be disconnected.

Messrs. Platt are also showing a roving waste opener which operates upon the workable "waste" fibre, by means of a 24in. diameter spiked lag cylinder regulated by cone drums. This machine is connected with the exhaust opener by means of a 6in. pipe, thus allowing of a certain percentage of the opened waste to be regularly and evenly blended with the opened cotton.

The necessary suction required for the cotton as it passes through the lattice feeder, the Crighton cylinder and the stationary grid dust trunk is provided by the exhaust cylinder of the opener lap machine, which performs the next operation.

We illustrate this grid dust trunk by Fig. 346, for, although in a primitive form, the stationary grid was one of the earliest inventions in the textile industry, it completely died out in favour of a movable lattice grid, because of its inefficiency in removing the heavier impurities. Its resuscitation in an improved form, as shown, is due to the introduction of the Crighton opener, which disposes of much of the heavy refuse matter, leaving the grid dust trunk to remove only the lighter foreign bodies, such as leaf, dust, &c. It will be seen that the grid is divided into small compartments, which allow the foreign matter to separate and fall into them below the air current. The complete trunk is made up of a series of boxes, generally seven in number, each being 3ft. long, and containing a grid of bevelled bars made up in either of the standard numbers.

The cylinder of the opener lap machine—as shown in Fig. 348—in conjunction with a fan, delivers the cotton on to the cages in the form of a level fleece. The fleece is then passed between feed rollers, and is either combed by a striker cylinder, where further impurities are removed, or scutched by a bladed beater. Thence it passes through the lap end cages to the calender rollers, which reduce it to the form of a level lap roll. The formation of a lap of even thickness and uniform consistency has always been one of the most important and delicate of the problems of cotton working. Its success depends on the proper regulation of the draught. The old method of shifting the diaphragms or the fans to effect this object has been replaced in this machine by a simple device which permits of the easy decentralisation in either direction of the in'et to the exhaust cylinder. This is of especial value when working with mixed grades of cotton, as with it cottons of varying densities, such, for instance, as Egyptian and American, can be worked up into a level lap sheet.

The lap sheet, as it leaves this machine, is wound round a central spindle, and four such rolls are superposed and fed simultaneously into the finishing scutcher. Any slight irregularity that may occur in the laps as they come from the opener is remedied here as the stuff passes under the regulating roller with its variable cone-drum feed. In lieu of the usual bladed beater, an 18in. striker cylinder is used on this machine.

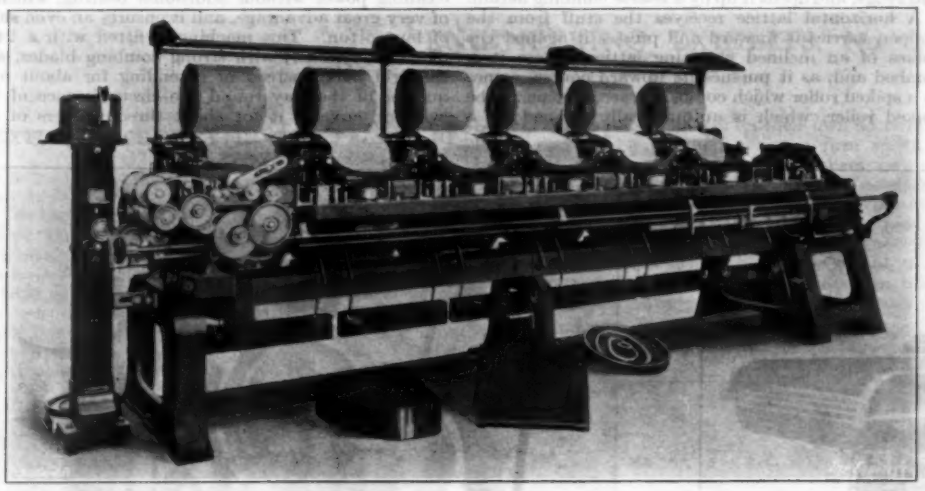


FIG. 351—NASMITH COMBER—J. HETHERINGTON AND SONS

The Carding Process.

At this point we come to an end of the processes carried out by Messrs. Platt Brothers and Co.'s machines, as far as this Exhibition is concerned, and arrive at the important and delicate operation of "carding." The machine selected for this purpose is a non-flexible bend revolving flat carding engine by Elijah Ashworth, of Manchester. Probably of all textile machines this is the most severely patented. We are told that it is covered by no less than twenty patents, and certainly the result is a highly elaborate and effective machine—Fig. 350.

The function of the carding engine is to open up the cotton still further, effect the final cleaning of the fibre, and transform the lap roll into a filmy fleece in the form of a loose circular untwisted rope, known as a "sliver," and to deliver that sliver into a tall vertical cylinder or can.

The process of the carding engine is carried out as follows:—The lap roll is first passed between a roller and a feeding plate, and while gripped by these is combed by a saw-toothed roller. Thence the material passes to the surface of the main cylinder of the machine, which is of large diameter and its surface is covered with fine metal teeth. The opening is effected by passing the cotton between this set of teeth and another set which travel at a speed lower than those on the main cylinder. From this the cotton passes on to a smaller toothed cylinder, from which it is moved by an oscillating comb and is gathered up in the "sliver" form already mentioned. Without going into details, we may say that, while the whole of this machine must be perfectly made and adjusted, the most fundamentally important essential is that there must always be perfect concentricity between the card cylinder and the "flats" which encircle a portion of its periphery, and the slightest wear on the bearings or on the flats must be compensated for at once. When we bear in mind that the distance between the cylinder and the flats is only the thickness of a sheet of writing paper, the necessity for accuracy is at once apparent. Prevention of wear is provided for as far as is humanly possible by an ingenious method of driving, and a remedy for it is there in the form of a simple means of gauging and adjustment to less than one thousandth of an inch. Similarly uneven wear on the wires on the flats is corrected by an emery grinder of special design which is fitted to the machine.

Lap and Combing Machines.

Next we come to three machines made by Messrs. John Hetherington and Sons, of Manchester. The first of these is a sliver lap machine—Fig. 349—which receives the sliver from the carding engine and once again transforms it back into a lap and winds it round a central core. In the process, the cotton has been considerably attenuated by passing through drawing rollers, which reduce the number of fibres in a cross section of the material. This process produces a lap only 9in. in width.

The next is a ribbon lap machine which takes six of the lap rolls produced by the preceding machine. The cotton from each of these rolls passes again through drawing rollers and is further attenuated and the fibres are straightened. Then the six laps, or webs, are superposed, making a single lap of absolutely even texture and thickness. Again the lap is wound round a centre core.

From the ribbon lap machine the cotton passes to a Nasmith comber—Fig. 351—the object of which is to effect the final parallelisation of the fibres and to remove all those which are short or broken. Six lap rolls are operated on simultaneously in this machine, which effects its purpose by means of a combing cylinder and seventeen rows of needles. This machine has every device for the efficient combing of the stuff, first by coarse needles and finally by fine needles at a slow feed. Each nipper carries its own feed roller which receives its motion from the movement of the nipper itself, and is adjustable by means of a ratchet and pawl. The cotton now is in a condition for the finest grades of winding.

The Drawing Frame.

But before we proceed to the winding we must hark back a little, because, for the coarser "counts," i.e., grades of threads, we can eliminate the three last machines and substitute for them a single machine, a drawing frame. The machine of this type exhibited is by Asa Lees and Co., Limited, of Oldham, and is illustrated by Fig. 354. The drawing frame takes the cotton direct from the carding engine in sliver form and attenuates it, thereby straightening the fibres in a single process. This operation is performed by a series, or any number of series of rollers, each series consisting of four pairs of rollers. In each series, the second, third and fourth pairs run progressively faster than the preceding pair, thus effecting the desired attenuation. A number of the slivers from the carding engine are combined to pass through each series of drawing rollers, and drawing frames are made to accommodate from 20 to 140 cans of slivers, according to the output required and the number of "heads" on the machine. Thus the drawing frame reduces a large number of slivers from the carding engine into a small number of slivers, but attenuates them so that the resultant sliver from each head, though made up from many, contains less fibres to the cross section than those which it received from the carding engine. The quality of the sliver, however, is greatly improved

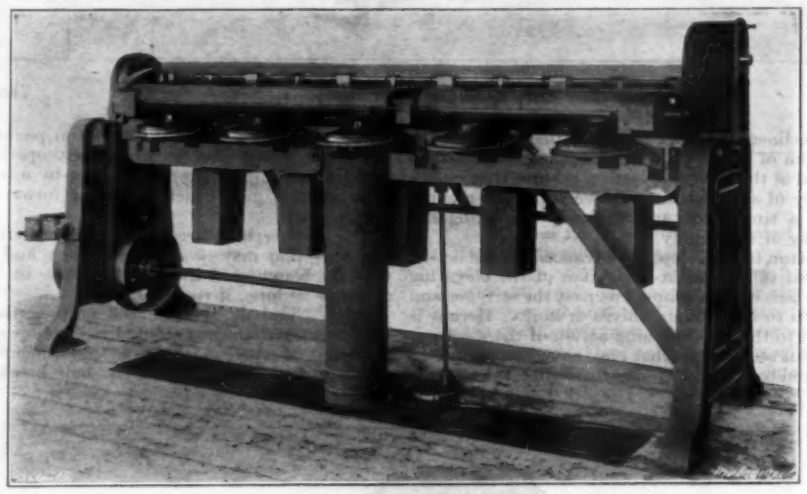


FIG. 354—DRAWING FRAME—ASA LEES AND CO.

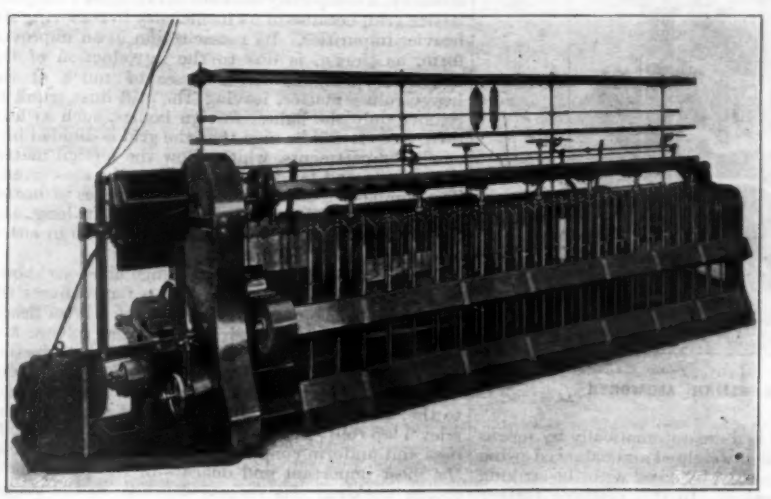


FIG. 352—INTERMEDIATE FRAME—BROOKS AND DOXEY

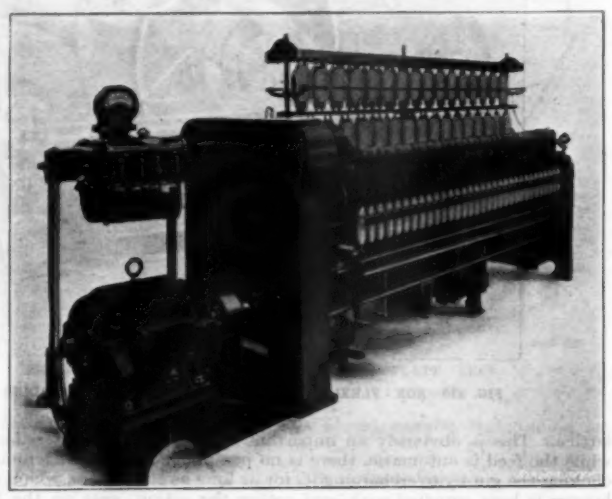


FIG. 353—RING SPINNING FRAME—DOBSON AND BARLOW

by the regularising of the density and more perfect parallelisation of the fibres.

So far we have dealt only with the cleaning and opening of the cotton, the straightening of the fibres and equalising of the density of the product. At this stage we have a material which, though in rope form, is untwisted and of so delicate and filmy a nature that its fabric and its form can be destroyed by a mere touch of the finger.

The Spinning Plant.

We now come to the twisting of the cotton, although we have by no means yet come to the end of the attenuation process, for this goes on during the progress of the cotton through the next three machines, the "slubbing," the "intermediate," and the "roving" frames.

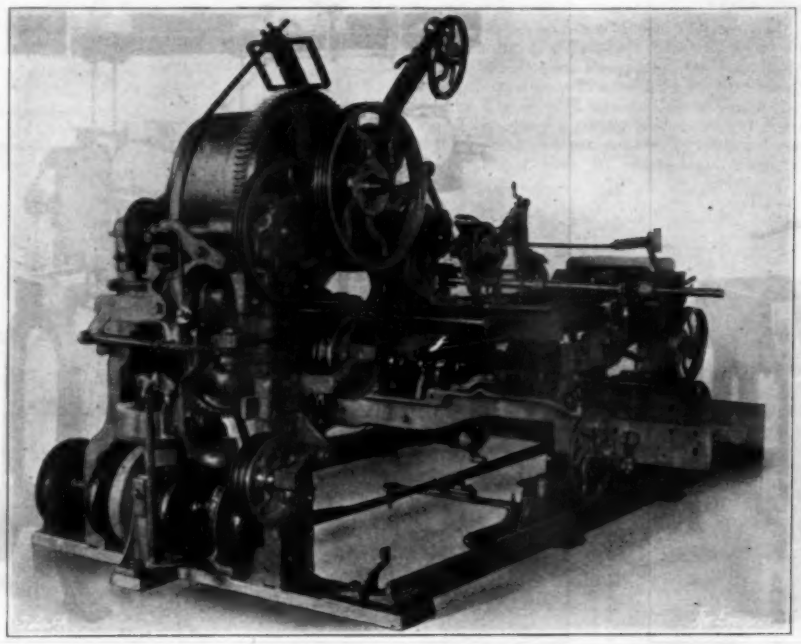


FIG. 355—HEADSTOCK FOR SELF-ACTING MULE FOR SPINNING WEFT YARN—ASA LEES AND CO.

The slubbing frame, in which the first twist is imparted to the material, takes the slivers either from the comber or the drawing frame according to the process followed. This machine is by Asa Lees and Co., and it is here for the first time that the cotton is wound upon a bobbin. Only just enough twist is imparted to the sliver to give the thread sufficient strength to enable it to be drawn off the bobbin by the next machine.

In the intermediate and roving frames, the former of which—illustrated by Fig. 352—is by Brooks and Doxey, Limited, of Manchester, and the latter by Dobson and Barlow, Limited, of Bolton, the cotton is further elongated, twisted and "doubled." It then passes either to the ring frame, which is a continuous winder, or to the mule which is an intermittent spinner, and produces a more even and regular quality than the ring frame. The ring frame, which is illustrated by Fig. 353. is also by Dobson and Barlow, and is designed for spinning 28's to 50's on to wood bobbins at a spindle speed of 8500 revolutions per minute. The self-acting mule for spinning weft yarn, the special headstock of which is shown by Fig. 355, is by Asa Lees and Co. It has 250 spindles and embodies the firm's recently patented steel carriages. This firm is also showing a mule for spinning "waste" cotton. A feature of this machine is that the mule carriage automatically increases its speed of traverse progressively in order to accommodate itself to the easily breakable waste thread with which it has to deal.

Next comes a ring doubling frame by Brooks and Doxey—see Fig. 356. The work of this machine is to twist two parallel threads into one.

Winding and Thread-finishing Machines.

Arundel, Coulthard and Co., of Stockport, are showing a patented quick traverse winding frame, which takes the thread endwise from the ring bobbins and winds them either on to parallel or conical spools, and will take from one to six threads to each spool. The conical winding is effected by an ingenious form of adjustable cradle.

We now come to a series of machines by Joseph Stubbs, Limited, of Manchester, for finishing off the cotton before it is placed upon the looms. These are a Rabbeth spindle winder, a quick traverse cotton gassing frame, an improved bobbin reel, a yarn bundling pirn winder, a quick traverse winder and a high-speed pirn winder.

The Rabbeth spindle winder—which we illustrate by Fig. 357—is fitted with self-contained high-speed winding spindles, two rows of which are on each side of the machine. The creel is fitted with a patented tapering motion for winding single-flanged bobbins from cops and spinning or doubler bobbins. The traverse motion is simple, and can be altered to suit different lifts of bobbins without changing the wheel. In this machine also the yarn is cleared of all excrescences in the shape of lumps caused by knots, fragments of seeds, &c. This is done by passing the thread between narrow slits known as "clearers," the narrow apertures being in effect gauges of the finished diameter of the yarn.

The next machine is the quick traverse gassing frame—Fig. 358—one of the most ingenious and popular of the machines on this stand. In this machine the yarn, which is guided by the smaller grooved wheels clearly shown in the picture, is passed eight times, and at speeds varying from 4000in. to 8000in. per minute, through a gas flame, and is wound by a quick traversing movement on to wood tubes from bobbins, which are fixed above the gas ventilator. The secret of the success of this machine lies in the uninterrupted passage of the yarn through the flame at a determined and regular speed, on the quality, regularity and constant heat of the flame, and on the uniformity of the gas pressure. The gas is mixed with air, and all the factors that affect combustion are stabilised automatically by passing the gas through a Selas-Turner patented mixer. The flames are varied to suit different qualities and "counts" of yarn, as aslo different rates of feed, by means of a special valve and micrometer index, in addition to the usual stop cock.

The improved bobbin reel winds twenty hanks per side, and the creel is arranged for single-flanged bobbins or quick-traverse gassing frame spools.

The quick-traverse close winder—as illustrated by Fig. 359—has a creel for the multiple winding up to eight ends. It will wind either parallel "cheeses" or conical spools. The traverse can be varied up to 6in. by means of exchange cams. This winder has six heads, each driving independently.

The high-speed pirn winder is of the self-contained spindle type. The spindle speeds can be varied to suit different qualities and "counts" from 1980 to 3200 revolutions per minute. This machine supplies the weft for the looms which follow.

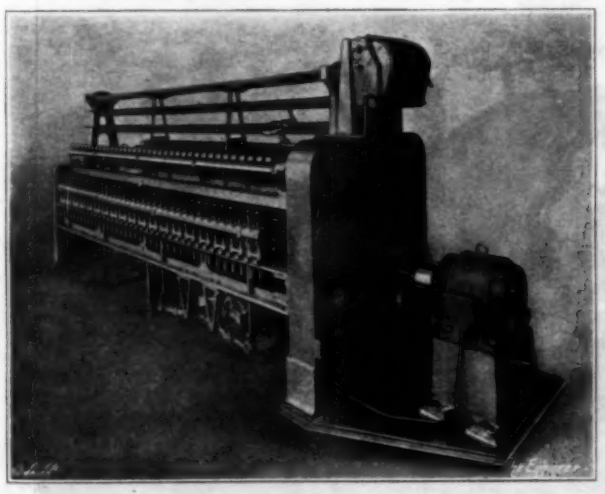


FIG. 356—RING DOUBLING FRAME—BROOKS AND DOXEY

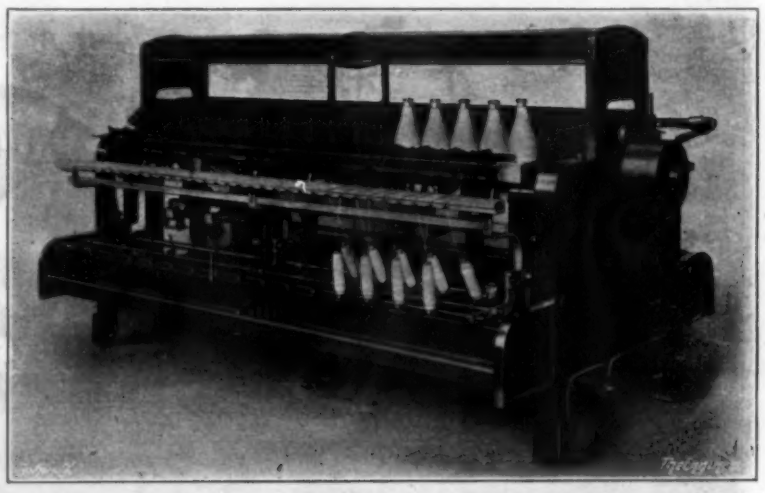


FIG. 357—RABBETH SPINDLE WINDER—JOSEPH STUBBS

Waste Machines.

Before coming to the weaving, however, it should be noted that there is a complete set of machines for working up the "waste," i.e., the very short fibres and the broken fibres discarded at various points by the machines we have described, which formerly was considered to be worthless. For this purpose Wm. Tatham, Limited, of Rochdale, has a set of carding machines, which we illustrate by Fig. 360. The set is 60in. wide, and includes an automatic feeding machine, single breaker carding engine, parallel fibre feeder, single finishing carding engine and leather tape condenser. This last divides the web into 160 slivers, which pass between leather bands arranged so as to exert both a forward and reciprocating motion, which has the effect of rubbing the slivers into thread form, so that they may be wound on to bobbins ready for the waste spinning mule to which we have already referred.

Testing and Measuring Machines.

The minute and fastidious accuracy with which all these yarn-producing machines must do their work has led to the invention of a highly scientific series of machines for readily and accurately testing and inspecting the materials at different stages.

Goodbrand and Co., Limited, of Stalybridge, are exhibiting a set of such machines. Without them it would be impossible to carry on the work at any textile mill with anything like efficiency. Among them are a wrap reel for measuring the lengths of finished yarns, a wrap block for measuring the lengths of yarns in various stages of production, a motor-driven machine for testing the strengths of yarns, a single thread tester both for tensile and torsional stresses and various balances for ascertaining the counts of yarn, &c. The first three of these are illustrated by Figs. 361, 362 and 363 respectively.

The Looms.

We now come to the weaving plant which comprises fifteen machines. This department is separated from the spinning section by a corridor. In it we come upon a totally different set of makers, viz., the manufacturers of looms and dobbies. This section is also differentiated from the rest of the plant

by reason of the fact that not only are these looms at work on the cotton threads produced by the machinery just described, but are also weaving silk and that mysterious modern textile which is cutting so sorely into the cotton industry and into the trade of the makers of cotton opening and spinning plant—artificial silk. Some of these looms are weaving cotton and others artificial silk fabrics, and some are blending the two.

Although the process of manufacturing artificial silk thread is not exhibited here, samples of its ingredients are shown elsewhere in the Palace of Industry, and it is interesting to note, in passing, a fact which is not generally known. That is, that artificial silk is entirely made out of cellulose produced from very finely pulverised wood. In this form, it is squeezed through minute perforations, until it resembles for all the world microscopical spaghetti, in which form it can at once be spun. There are no short fibres to be dealt with in artificial silk for all fibres can be of unlimited length. There is no parallelisation of fibres to be done, as from the start they are all parallel. There is no attenuation to be done, as the consistency and density of the fibres is equal all through. These are the reasons why the advent of artificial silk is a severe blow to the makers of cotton spinning plant, its only redeeming feature being that, although it is easily woven, it "makes up" better for many uses as a blend in a cotton fabric than as an all-artificial-silk product.

Of the fourteen looms shown, one may say that their virtues lie mainly in the fact that they are all of the very latest patterns, and that between them they cover practically every type that can be required in the general textile industry. Twelve different makers have been concerned in the production of them, and, as already mentioned, a number of different firms have made the dobbies used on some of them. Between them, they are turning out every sort of woven article produced in the industries concerned, from silk and cotton dress materials, shirtings and other things of which we do not understand the names, down to Turkish bath towels and Malayian sarongs of intricate designs.

Cooper Brothers, Limited, of Burnley, have two looms, one of which—Fig. 369, page 212—is for shirting cloth, and has a 40in. reed space and a very rapid reed. It has a spring top motion for weaving up to six shaft cloths, and it can do up to 220 picks per minute. The other—see Fig. 370—is specially designed for bath towel production at a rapid rate, stopping automatically when the proper length of towel has been woven and the fancy border applied under the direction of the patented dobby, made by Lupton and Place, of Burnley.

George Hodgson, Limited, of Bradford, is also showing two over-pick 40in. reed space, single shuttle looms. One of them—Fig. 364, page 208—has a five-shaft inside treading motion and is provided with frogs and an upright spring which acts as a shock absorber when the loom knocks off. A trigger spring motion which facilitates the removal of the finished work is a feature of this machine, which has also a back rail for easing the warp. The other loom by this firm, shown by Fig. 365, is a fast reed cotton loom, having a 16in. shaft gear-driven negative dobby with parallel slots.

Atherton Bros., of Preston, show one of their over-pick looms—Fig. 366. This is designed for fancy cloths and is fitted with a Jacquard attachment of the 400-hook double-lift and double-cylinder type, by Richardson, Tuer and Co., of Farnworth.

Another loom for fancy cloths—Fig. 371, page 212—is a six-shuttle circular box loom with sixteen-shaft dobby and leno motion, by Gregson and Monk, Limited, of Preston. The dobby on this machine is by Ward Brothers, of Preston.

W. B. White and Sons, of Colne, are showing a very versatile six-shuttle circular box loom with a special attachment for facilitating the turning movement of the box and relieving the strain on the rods and levers. This is done by means of a patented peg-wheel and T hammer. The loom has a sixteen-shaft, double-lift, open shed dobby and is designed for weaving very heavy warps.

Pemberton and Sons, Limited, of Burnley, are showing a loom for dealing more particularly with striped fabrics. It is fitted with a cross-rod tread motion. In this machine there is a special weighting mechanism for the yard beams which eliminates the use of heavy weights.

The loom shown by David Sowden and Sons, of Shipley—Fig. 367—is interesting as possessing a feature which eliminates from 60 to 90 per cent. of the

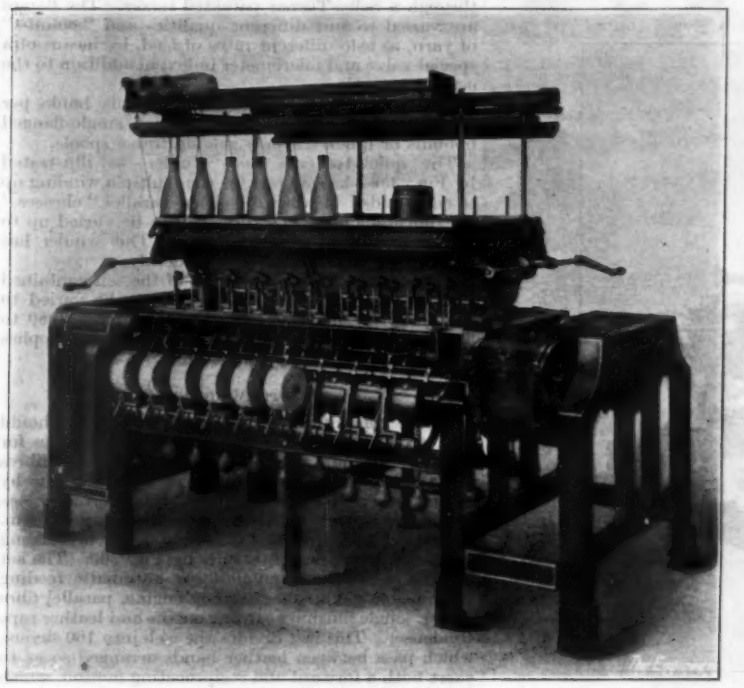


FIG. 358—QUICK TRAVERSE GASSING FRAME—JOSEPH STUBBS

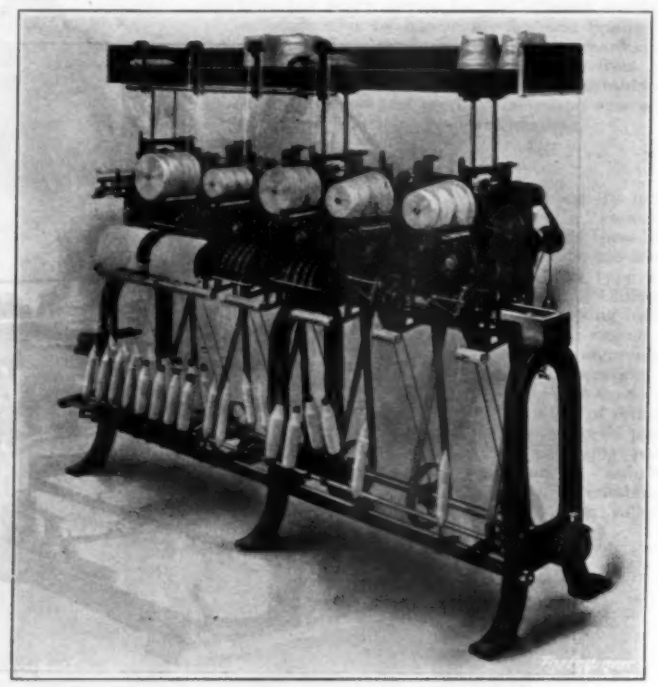


FIG. 359—QUICK TRAVERSE CLOSE WINDER—JOSEPH STUBBS

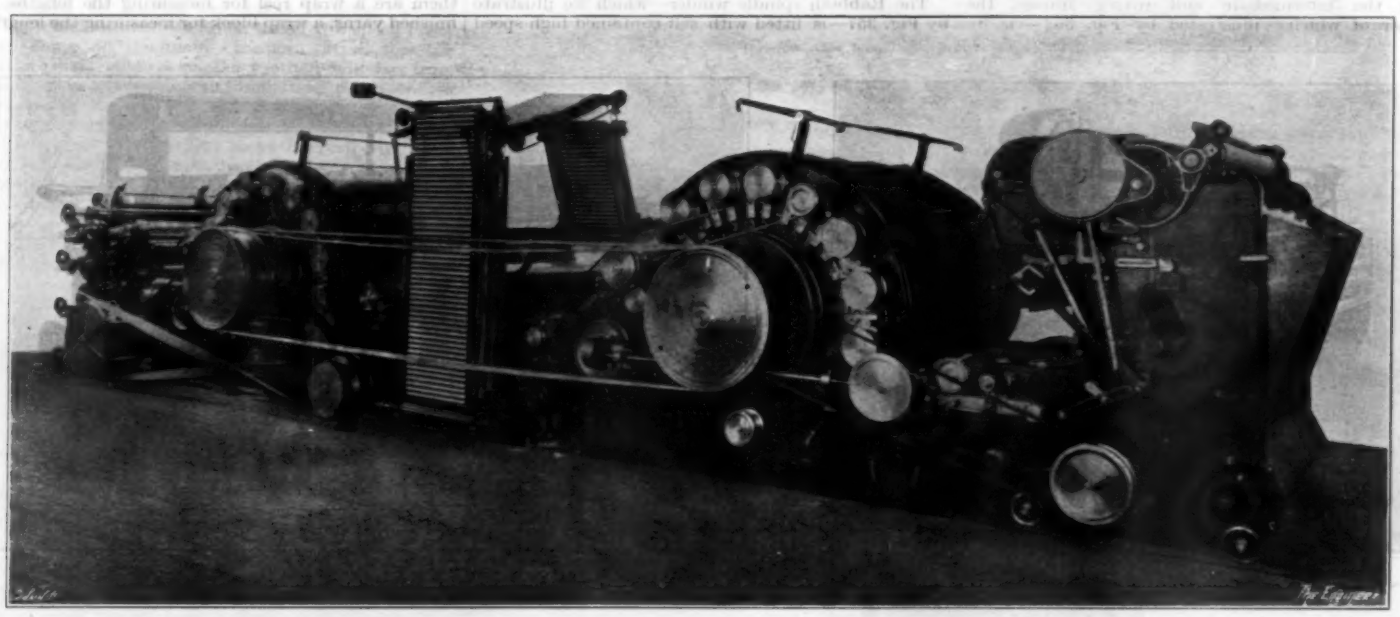


FIG. 360—SET OF WASTE CARDING MACHINES—WILLIAM TATHAM

cards used in weaving elaborate designs. This is done by the application of a double-cylinder card motion, which allows one cylinder to be used for the body and the other for the borders. It is used largely for the weaving of sarongs.

Henry Livesey, Limited, of Blackburn, is exhibiting one of its four-shuttle drop-box looms in which the changing of the boxes is done by locking eccentrics, and the method of changing the shuttles has been simplified and speeded up by a simple device. In this loom each box has its own vertical lifting lever, and the lifting of the boxes when the loom is stopped

is easily done. The steel cards, being in front of the loom, are readily controlled.

Another versatile loom is one shown by John Pilling and Sons, Limited, of Colne. It is of the 40in. reed space, fast reed, over-pick single-shuttle type and is intended for a large range of variety work in stripes and other patterns in any material.

Richardson, Tuer and Co., Limited, of Farnworth, have an under-pick loom which claims to be almost as rapid as those of the overpick type, and has the advantage of very great versatility in the material with which it can deal.

Willan and Mills and Wm. Dickinson and Sons, Limited, both of Blackburn, are each showing a loom.

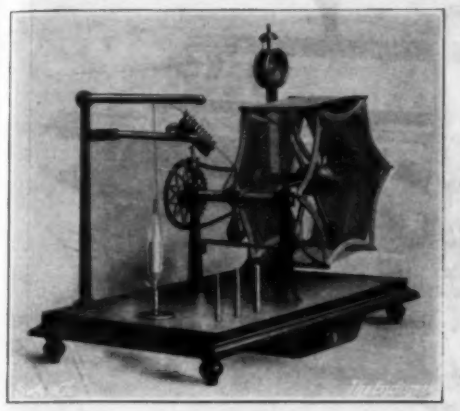


FIG. 361—WRAP REEL FOR MEASURING YARN—GOODBRAND

The former is of the over-pick type and attains a high speed while working with sixteen shafts.

ACCESSORY MACHINES.

The cloth "plaiting" machine shown by Hacking and Co., of Bury—Fig. 368—does not "plait" in the ordinary non-textile meaning of the word. It is, in fact, a highly ingenious automatic folding and measuring machine for cloth and other finished fabrics. Although the original mechanical "plaiter" was made by this firm eighty years ago, the machine shown possesses several quite new features. The most important of them is the introduction of a concave table on which the material to be folded is laid. It has been found that when folding thick or soft materials the centre portion has a tendency to bulge or rise. This is more accentuated in some materials than in others, and so the degree of concavity can be varied from zero to a depth of 3in. at the centre. This is done by making the table in two parts and giving each

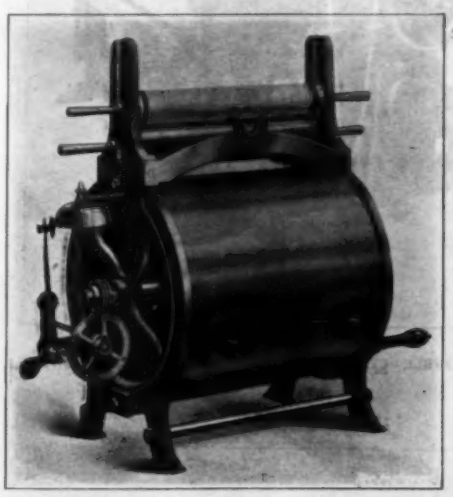


FIG. 362—WRAP BLOCK FOR MEASURING YARN—GOODBRAND

an adjustment to suit the case. The two parts of the table incline inwards, permitting most of the cloth to lie in the middle of the table, thus offering no obstruction to the fold being automatically and accurately measured. In the process of "plaiting" each fold is taken across the table from one grip rail to the other. The "knives," i.e., the thin edged reciprocating bars round which the fold is made, move in a straight horizontal line and each fold is measured independently of the others. The length of the fold is determined by the stroke of the knives, which can be varied as required. Thus the accurate measurement of each fold as it is made is ensured, and the machine works equally well on any fold from 12in. to the maximum, which is 42in. The registering is done simultaneously with the completion of each fold by an intermittent indicating device. The tension of the springs on the table can be readily varied to suit different weights of cloth by means of a worm and quadrant adjustment.

Various dobbies and special motions, by Ward Bros., of Blackburn, and by James Hill and Son, Limited, of Keighley, are to be seen on some of the looms exhibited, as so is the Stott and Smith patented "Terry motion," by Lupton and Place, of Burnley, which is used in different types of dobbies.

One of the most interesting of the exhibits by Ward Bros. is the Dobson "reacher-in," which enables a single operative to thread with great rapidity the healds and reed on a drawing-in frame. The various bobbins used on these machines are by Wilson and Co., Limited, of Burnley.

The whole of this elaborate textile mill is driven by electricity, the lion's share of the motors used being made by Mather and Platt, Limited, of Manchester, who have also fitted this factory and the rest of the cotton section with an installation of Grinnell sprinklers, fire alarms and fire doors. Other motors have been made by the English Electric Company, the Metropolitan Vickers Company, and the Lancashire Dynamo Company. The switchgear and starters are by George Ellison and Erskine Heap and Co.

One of the very striking and excellent features in connection with this remarkable exhibit is that everybody connected with it, whether in black coat or

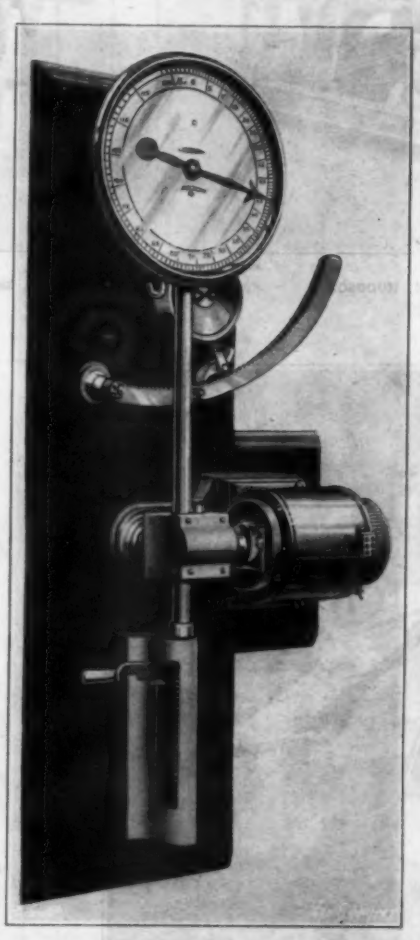


FIG. 363—YARN STRENGTH TESTING MACHINE—GOODBRAND

overalls, is obviously a thorough expert in his work and a master of the intricacies connected with this elaborate machinery. Some, we understand, are employed in a "collective" capacity and others are the representatives of individual firms, but all are efficient, and it is this general tone of efficiency of both man and machine which makes this particular exhibit so attractive and at the same time easily understandable.

The moral to be derived from this collective exhibit is that, while as a whole it must be an enormously costly affair to produce and run, the cost to the individual exhibitor who participates in it must be reasonable enough, when we reckon the number of firms which are sharing that expense. Not one of them could have obtained an equally effective display individually for an expenditure of many times more than his share in the cost of this exhibit. Moreover, there is no difficulty whatever in ascertaining the full lines of each of the makers concerned, as this information is prominently displayed in the section, although all the machines he makes may not actually be exhibited.

THE centenary of the Baltimore and Ohio Railroad, which will be celebrated in 1927, has been made the subject of a joint resolution in the Legislature of Maryland, under which the governor of the state is authorised to appoint a commission of seven members, to serve without compensation, to co-operate with the railway company and the city of Baltimore in conducting a suitable celebration. The charter of the company was granted on February 28th, 1827.

Obituary.

GILBERT GILKES.

WE regret to have to put on record the death of Mr. Gilbert Gilkes, M. Inst. C.E., the governing director of Gilbert Gilkes and Co., Limited, which occurred at his home, Lynnside, Kendal, after a long illness, on the 13th inst., on his seventy-ninth birthday.

Mr. Gilkes, who was the son of the late Mr. Bedford Gilkes, of Nailsworth, Gloucestershire, was born on August 13th, 1845, and was educated at the Friends' School, Kendal. On leaving school he served his apprenticeship as an engineer at the works of Messrs. Gilkes, Wilson and Co., of Middlesbrough, of which firm his uncle, Mr. Edgar Gilkes, was a partner. He soon gave proof of his capabilities, and at the early age of twenty-one years he was engineer-in-charge of the large bridge over the river Dee at Kirkcudbright, a most responsible post for one so young. He rose to be general manager of the firm before leaving.

After spending a few years in Birmingham, he purchased in 1881 the engineering business of Messrs. Williamson Brothers, hydraulic engineers, of Kendal. Under his guidance the business, the name of which was changed first to Gilbert Gilkes and Co., and subsequently to Gilbert Gilkes and Co., Limited, gradually expanded, and from being a small local concern developed into one with a world-wide reputation. Although during the latter part of his life he did not take a very active part in business affairs, he retained the chairmanship until the year 1920, when he was succeeded by his nephew, Mr. Norman F. Wilson, Assoc. M. Inst. C.E.

Mr. Gilkes was an original member of the Westmorland County Council, and an alderman from 1895 to 1921, when he retired. For twenty-one years he was chairman of the Westmorland County Education Committee, and in that capacity was largely responsible for the organisation and administration of the schools under the Education Act, 1902. He joined the Kendal Town Council in 1895, serving as mayor for the three successive years 1899, 1900 and 1901. He was also chairman of the Kendal Education Committee during the whole of his term of office in the Council. Mr. Gilkes was a magistrate for Westmorland and for Kendal borough, and for twenty years a member of the Westmorland Standing Joint Committee, of which body he was chairman for more than three years. He was a man of exceptional ability and physique.

SIXTY YEARS AGO.

A REMARKABLE accident on the North London Railway was recorded in our issue of August 19th, 1864. A train standing at Camden-road Station was about to proceed to Fenchurch-street Station under the charge of an engine that had just been coupled to it, when the driver, alarmed by a report proceeding from the fire-box, jumped off the footplate. The fireman was about to follow his example, when a second and louder report was heard, and the engine, weighing more than 20 tons, flew high into the air, wrecking the telegraph wires 12ft. to 14ft. above the level of the rails, knocking down the buttress of the bridge on which it was standing, and, turning over and completely round, alighted in the street below. The fireman appears to have lost his life, but no one else was injured, except the driver, who was badly scalded. Three remarkable features of the accident are worthy of note. In the first place, in spite of its somersault, the engine alighted upright on the street, and remained standing on its wheels. Secondly, had the accident happened a second later, a man and cart would have been exactly on the spot which the engine struck. Thirdly, but for the snapping of the engine draw hook at the moment of the accident, the carriages, instead of being left standing on the rails unaffected by the mishap to the engine, would probably have been dragged over by the engine into the street below. Dealing with the mishap and others of a similar nature that had recently occurred, we expressed the opinion that the frequency with which locomotive boilers exploded in this country represented a disgrace to the profession, particularly as of all classes of boiler, the locomotive was under skilled professional supervision. Why, we asked, did so few locomotive boiler explosions occur on the continental railways? We answered this question unhesitatingly that it was because abroad the hydraulic test was compulsory, and in some countries was periodically applied by law. It was, however, argued that the hydraulic test was a blind and possibly misleading one, if it were not followed by careful examination and measurement of the boiler. In this connection we drew attention to the legal regulation governing the testing of boilers in Bavaria. Under this regulation the temporary and permanent increase in the internal volume of the boiler when subjected to twice its normal pressure, had to be determined during the course of the hydraulic test. The measurement was effected by noting the amount of water pumped into the boiler while the pressure was rising from atmospheric to that of the proof load, and the amount subsequently lost through a tap used to release the pressure and reduce it to normal. Something, we concluded, must be done to diminish the number of "these terrible disasters," even though it entailed direct Government supervision. Opponents of the hydraulic test stigmatised it as a groping in the dark, "but what Mahometan," we wrote, "could more blindly bow to inevitable fate than some of our fatalist locomotive superintendents?"

EMPIRE EXHIBITION—SOME TEXTILE MACHINES

(*For description see page 202*)

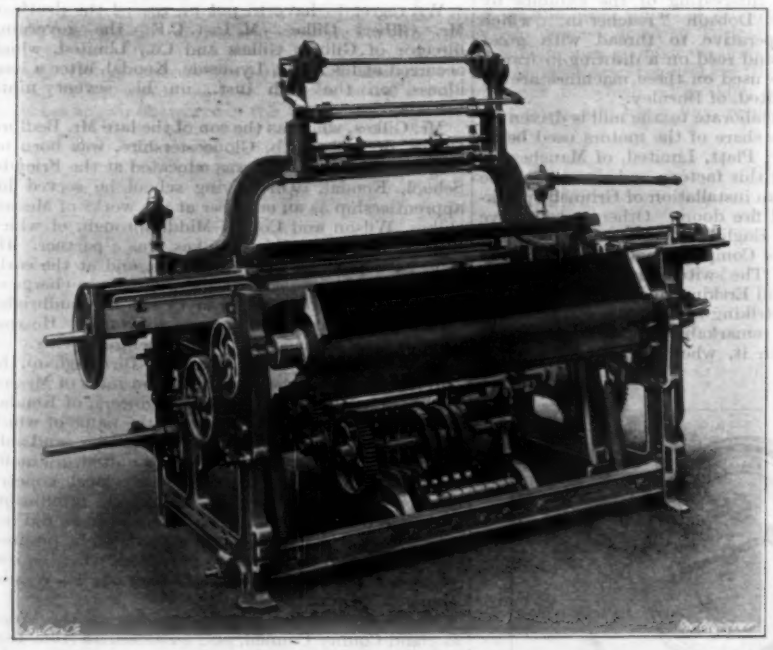


FIG. 364—OVER-PICK LOOM—GEORGE HODGSON

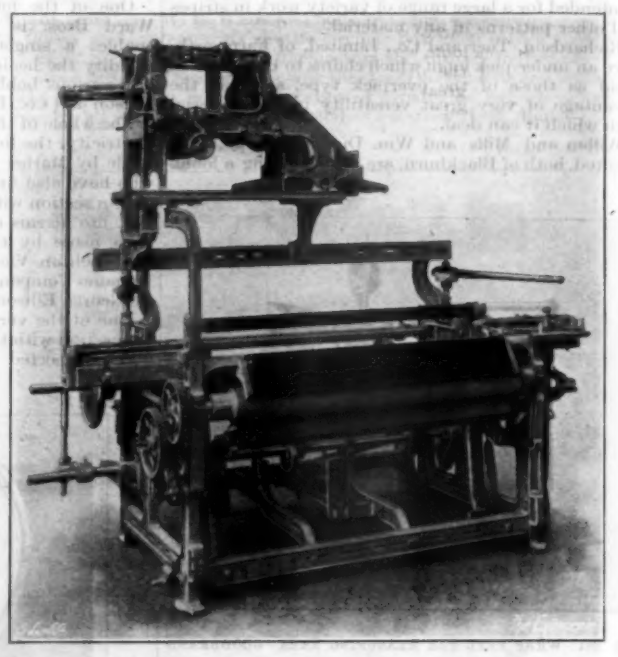


FIG. 365—FAST REED OVER-PICK LOOM—GEORGE HODGSON

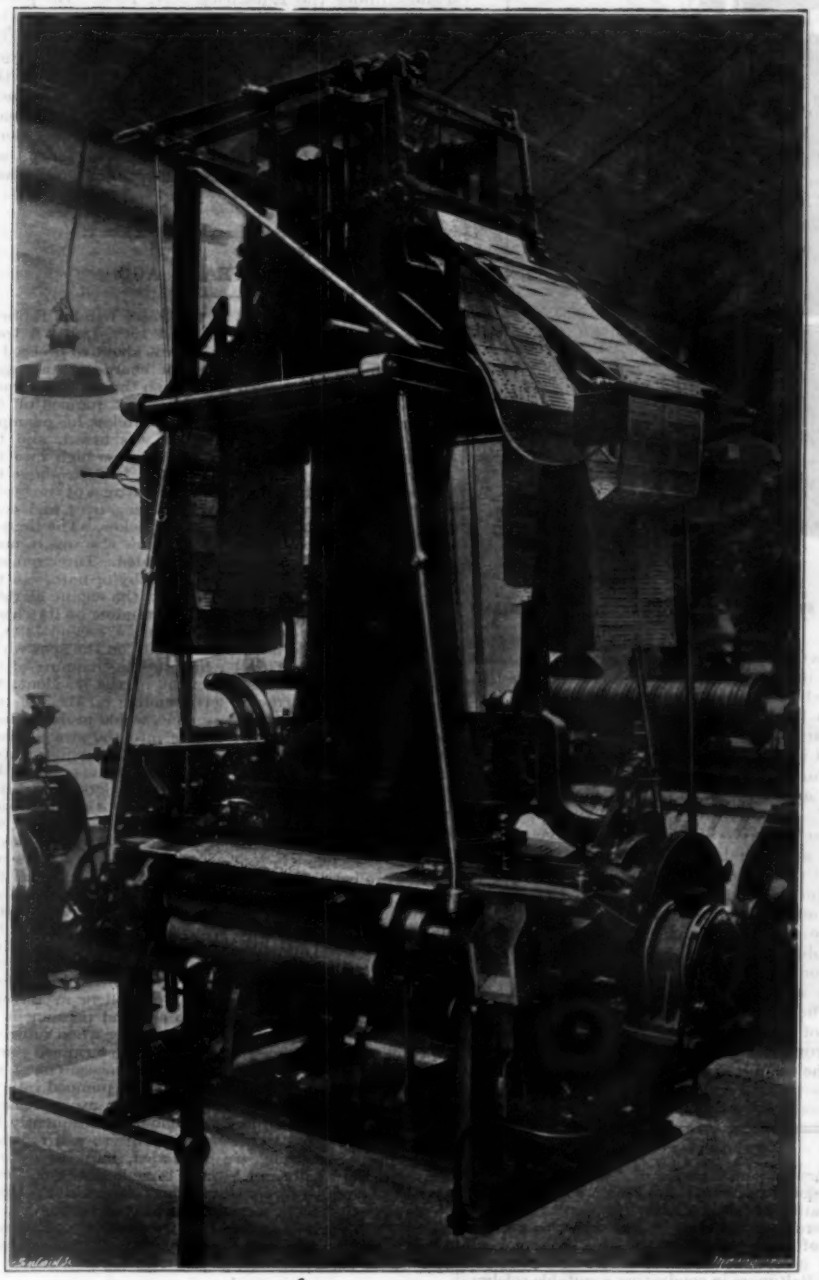


FIG. 366—HIGH-SPEED OVER-PICK LOOM FOR FANCY TEXTILES—ATHERTON BROS.

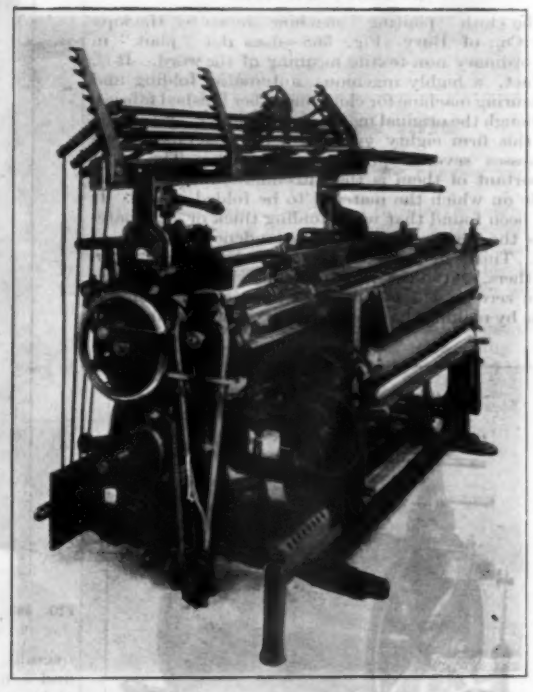


FIG. 367—DOUBLE-CYLINDER CARD MOTION LOOM—D. SOWDEN AND SONS

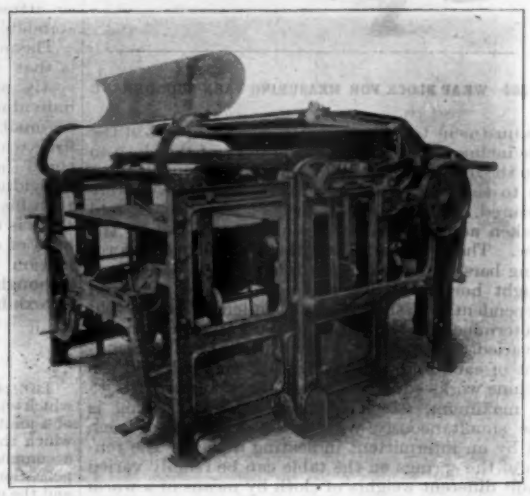
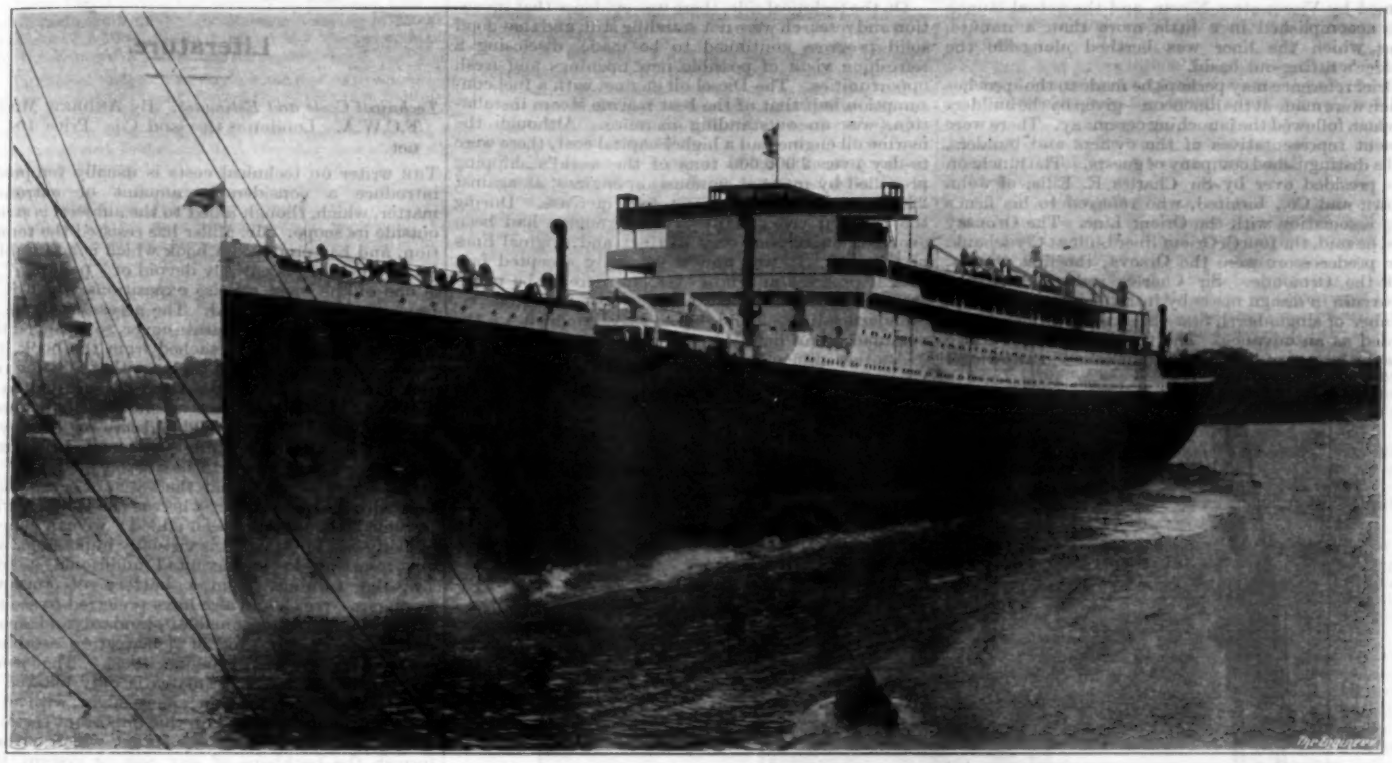


FIG. 368—AUTOMATIC "PLAITING" MACHINE—HACKING

THE LAUNCH OF THE ORIENT LINER ORONSAY

JOHN BROWN AND CO., LIMITED, CLYDEBANK, BUILDERS AND ENGINEERS.



The Launch of the Orient Liner Oronsay.

THE launch of the new 20,000-ton twin-screw Orient liner Oronsay took place on Thursday, the 14th inst., at the shipyard of John Brown and Co., Limited, Clydebank. This event must be regarded as important alike in the annals of post-war Clyde shipbuilding and in the rapid advancement of that new programme of improved liner service between Great Britain and Australia which the Orient Line is about to establish. The new vessel is notable in that she is the largest ship launched on the Clyde since the Cunarder Franconia took the water from an adjacent berth nearly two years ago, and, further, because she is one of the largest turbine propelled ships to be built since the end of the war. Again, with regard to her passenger accommodation, the Oronsay is, we learn, the first of the Orient Line's boats which has been designed *de novo* for first and third-class passengers only. This departure from earlier liner practice has enabled a larger amount of space to be devoted to public rooms and promenade decks, while a feature of the new design is the large number of single-berth cabins which has been provided. Indeed, it is claimed that the Oronsay and her two sister ships will possess more single-berthed cabins than any other passenger steamer afloat. The sister ships of the Oronsay, to which we have referred, are the Orama and the Otranto. They are both in course of construction at Vickers yard, Barrow-in-Furness, and, like the Oronsay, are 20,000-ton ships. These three new liners, together with the company's 15,000-ton liner Ormonde, will eventually take up the monthly sailings of the Orient Line fast mail service to and from Australia. The Oronsay is scheduled to make her maiden voyage early in February next year, and the Orama, which was described in THE ENGINEER for May 23rd, is expected to sail on November 15th, while the Otranto will, all being well, be completed within about eighteen months' time.

Accompanying this article are views of the Oronsay on the stocks before launching and immediately after she had taken the water. The following are the leading dimensions and particulars of the new ship :—

Hull.

Overall length	657ft. 6in.
Breadth	75ft.
Depth to upper E deck	47ft.
Gross tonnage	20,000 tons
Number of passengers carried, about	600 first-class and 1220 third-class

Machinery.

Type	Twin-screw, single-reduction geared turbines, Brown-Curtis type
Total shaft horse-power	20,000 S.H.P.
Astern power, about	70 per cent. of ahead
Number of boilers	Six double-ended and four single-ended
Working pressure	215 lb. per sq. inch

When completed, the Oronsay will have a handsome appearance, which will be contributed to by her graceful lines and her long cruiser stern. She will carry two large funnels and extensive deck erections. In all, there are eight decks, seven of which will be used by the passengers. The vessel has been constructed in accordance with Lloyd's highest classification, and with the rules of the Board of Trade and the Commonwealth Government for first-class passenger ships. Safety requirements have received careful consideration, both in regard to subdivision and the provision of life-saving appliances. The water-tight subdivision of the ship has been designed in full accordance with the International Convention regulations for the safety of life at sea, and there are twelve transverse water-tight bulkheads which extend up to F deck. Additional protection at the sides of the machinery spaces is furnished by the insertion of side bunkers and wing tanks, and similar provision is made in the case of the compartments immediately forward and aft of the machinery spaces, where water-tight doors exist below the 'tween deck spaces. All the water-tight doors are capable of being operated by hand and by hydraulic power from the bridge. Lifeboats with Welin and Maclachlan davits will be carried, having sufficient capacity for the full ship's complement. In addition to the ordinary boats, there are also motor lifeboats. The wireless apparatus includes a new type of 1½-kilowatt C.W. polar radio equipment with a direction-finder and a portable wireless set for lifeboat use.

The double bottom of the vessel extends right fore and aft, and is made to serve for the carriage of fuel oil, fresh water and ballast water. There are three cargo holds and three 'tween deck spaces forward of the machinery rooms, and four cargo holds aft, besides the usual spaces for ship's stores, and provision is made for carrying refrigerated cargo.

PASSENGER ACCOMMODATION.

The total ship's complement will amount to about 2250 persons, including 600 first-class passengers, 1220 third-class passengers, and the officers and crew. The first-class accommodation includes fourteen special state rooms, each of which will be furnished with two bedsteads and will be provided with a separate bathroom, while another special suite is provided with two bedrooms, a private sitting-room and a bathroom. The first-class cabins include a very large proportion of single-berth cabins, and all the cabins are provided with either a window or a port-hole. Considerable care has been taken with the arrangement of the public rooms. A first-class dining saloon, with accommodation for over 300 persons and a foyer at its forward end, is situated at the forward end of F deck, and runs the full width of the vessel. It is a particularly spacious apartment, and the walls are panelled and are painted grey and white in Louis XVI. style. The tables and furnishings are arranged on the public restaurant system. Embarkation entrances are arranged on D and F decks and the main staircase with its elevator extends from F to B deck, where it joins the lounge. This apartment is almost 100ft. in length, and one of its outstanding features is its excellent lighting. Three bay windows are provided on each side of the room, and altogether there are forty-one windows and a large skylight over the stairway, which is decorated in a harmonious and pleasing manner. Furnishings of the Louis XVI. period are used. On the after part of B deck is the smoking room and veranda *café*, while the drawing-room is arranged forward on C deck. Special provision has been made for children, and a special children's dining-room is provided on the starboard side of D deck. There is also a playground of about 2000 square feet, which has been set apart for children's use. Ample space for promenading is available on three decks, A deck having been specially arranged for games. The third-class accommodation includes an exceptionally large dining saloon, two smoking-rooms and a lounge, all of which are comfortably furnished in appropriate styles. Ample third-class deck space has also been given. We may remark that particular attention has been paid to ventilation in all parts of the ship, and both natural and mechanical systems are used. All the deck machinery, with the exception of the windlass and two capstans, is electrically operated, and throughout the ship electric power has been used to a very large extent.

PROPELLING MACHINERY.

The Oronsay is propelled by two independent sets of Brown-Curtis turbine machinery of the very latest type. Each set of turbines consists of one high-pressure, one intermediate-pressure and one low-pressure turbine, working on series and each driving a separate pinion which engages with a common main gear wheel. Single-reduction helical gearing is used to transmit the power developed by the turbines to the propeller shafts, and the total shaft horse-power of both turbines is about 20,000. The main propeller shafts are of forged ingot steel, which is finished bright, and a Michell type thrust block is provided on each line of main shafting to take up the propeller thrust. Built-up four-bladed propellers, with manganese bronze blades and cast steel bosses, are employed, and cast iron cones are fitted over the propeller nuts.

A feature of the auxiliary machinery is the extensive use of electrically driven pumps. The main circulating pumps are steam driven, but motor-driven air pumps and centrifugal hot well pumps are installed. Steam-driven turbo feed pumps are fitted, and the feed heater is of the direct contact type. Other auxiliary machinery includes the necessary outfit of forced lubrication, sanitary, bilge, fresh-water and other service pumps, together with the complete evaporating and distilling plants, with the auxiliary condenser and its pump equipment.

Steam is generated in six double-ended and four single-ended cylindrical marine boilers, designed to produce saturated steam at a working pressure of 215 lb. per square inch. The boilers are arranged in two water-tight compartments and air for combustion is supplied by six electrically driven fans. The furnace fronts are fitted for oil burning, and the oil-burning equipment includes electrically driven oil fuel pressure pumps, oil fuel heaters and filters, a complete installation being fitted in each boiler compartment.

The vessel was launched in an advanced state, as it is expected that she will be ready for trials towards the end of January, 1925.

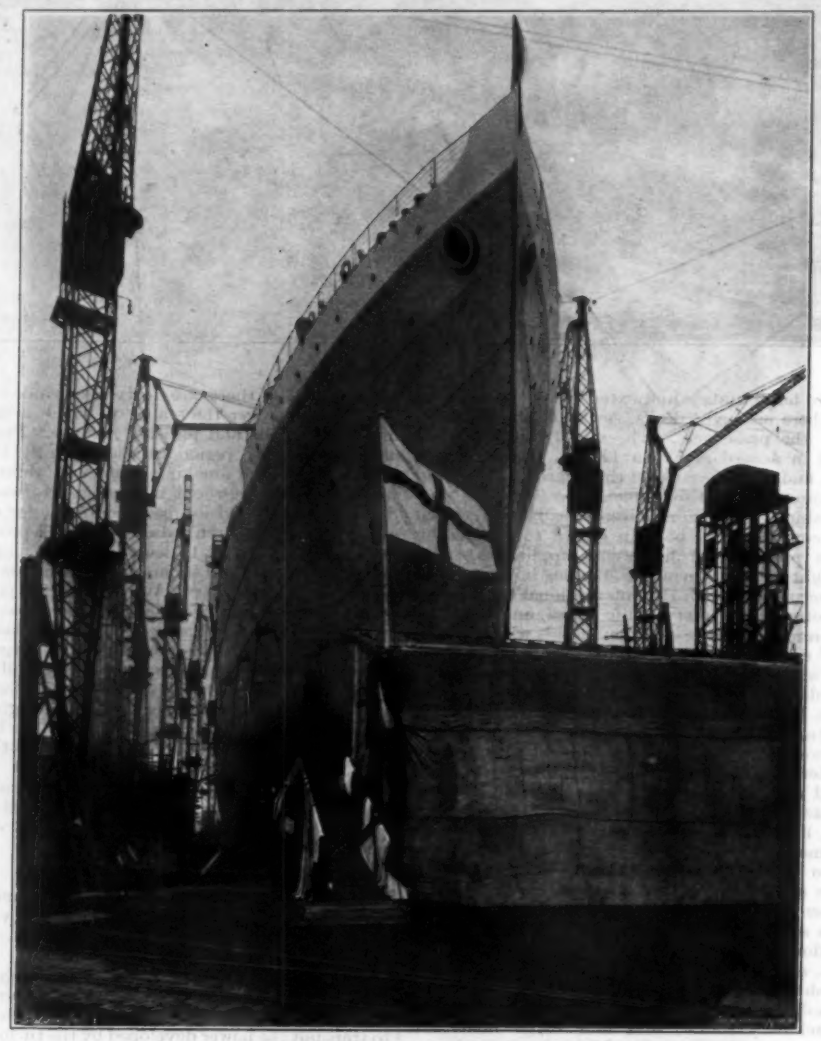
The Launching Ceremony.

The launching and naming ceremony was performed by Viscountess Novar, and the actual launch was accomplished in a little more than a minute, after which the liner was berthed alongside the builder's fitting-out basin.

Brief reference may perhaps be made to the speeches which were made at the luncheon—given by the builders—which followed the launching ceremony. There were present representatives of the owners and builders, and a distinguished company of guests. The luncheon was presided over by Sir Charles E. Ellis, of John Brown and Co., Limited, who referred to his firm's long association with the Orient Line. The Oronsay was, he said, the fourth Orient liner built at Clydebank. Her predecessors were the Orsova, the first Orama, and the Ormonde. Sir Charles remarked on the departure in design made by introducing such a large number of single-berth first-class cabins, which he regarded as an advance. The turbine machinery also was the largest of its type to be installed in any vessel in our merchant marine. Electrically driven auxiliary machinery, both in the engine-room and on deck, was a means of securing the highest economy. He congratulated the Orient Line and Sir Kenneth Anderson on the excellent service to Australia which the new liners would give. Sir Kenneth Anderson, the chairman of the Orient Line, said that it was always rather an adventure to launch a ship, and it was peculiarly an adventure to-day, for we were passing through the longest and deepest depression in shipbuilding within the memory of man. The Orient Line had certainly given proof of its faith in the future by building three of the finest steamers, the largest, fastest and most perfectly fitted for their trade. The change to one class of saloon passengers had already been introduced into some of the company's existing ships, but full advantage of the change could not be obtained unless the ship was designed with that end in view. Sir Thomas Bell referred, in his reply to Sir Kenneth Anderson, to the difficulties which faced the shipbuilder and the engineer to-day. A suggestion, he said, had recently been made that shipowners should defer building until they could do so on a basis that was economically sound. He did not see how the price of shipbuilding could possibly come down until considerable reductions had been effected in the cost in this country of both raw and finished materials, railway transport, prices of food, clothing and other commodities, rates and taxes, together with a reconsideration by shipbuilding and engineering labour of the working hours per week. He feared that this was more than could be hoped for the present.

On the technical side, there was evidence that invention and research were not standing still, and that good solid progress continued to be made, disclosing a refreshing vista of possible new openings and fresh opportunities. The Diesel oil engine, with a fuel consumption half that of the best marine steam installation, was an outstanding instance. Although the marine oil engine had a higher capital cost, there were to-day over 2,000,000 tons of the world's shipping propelled by internal combustion engines, as against 220,000 tons in 1914—a ten-fold increase. During the last ten years many types of engine had been evolved, embodying very distinct and original lines of thought. It was now a generally accepted fact that if progress and improvement were to be maintained, full scope must be given to individuality. Standardisation should be strictly confined to the manufacture of detailed parts and accessories.

Another difficulty which confronted the would-be users of marine oil engines was the question of the availability of sufficient oil supplies. According to Lloyd's Register, the most recent figures showed that there was over 17 millions of tons of mercantile shipping in the world fitted with oil-fired boilers. If a conservative estimate was made that only one-half of the oil fuel used by this tonnage was suitable for use on Diesel engines, then by gradually diverting it for that purpose, there would ultimately be 8½ millions of tonnage using oil fuel under boilers. This tonnage would in all probability include ocean-going vessels having machinery of 20,000 shaft horse-power and upwards—say, from the Oronsay and her sister ships up to the largest Atlantic liners, also fast cross-Channel steamers and coasting steamers, especially in America. To this 8½ millions of oil-fired tonnage, 17 million tons of Diesel tonnage could be added without making any greater demands upon the oil companies than at present, when they certainly did not appear to be suffering from oil shortage. It might also be borne in mind that prior to the war the Russian oil district of Baku exported nearly 3½ million tons of oil of Diesel quality, over and above that used for lubricating and illuminating purposes. This quantity, if brought into the world's markets, would provide for another 3½ million tons of Diesel propelled ships, for, on the assumption that ships steamed 240 days per annum, 1 ton of oil per annum provided a generous margin for the fuel consumption required for each gross register ton of motor shipping.



THE ORIENT LINER ORONSAY BEFORE LAUNCHING

Literature.

Technical Costs and Estimates. By Andrew Miller, F.C.W.A. London: Gee and Co. Price 10s. 6d. net.

The writer on technical costs is usually tempted to introduce a considerable amount of extraneous matter, which, though allied to the subject, is strictly outside its scope. Mr. Miller has resisted the temptation, and has produced a book which is admirable in its succinctness, is entirely devoid of "padding," and is one of the most concise expositions which it has been our pleasure to read. The necessary forms and charts are bound in a separate cover, so arranged that, while they cannot be detached from the book, they can be opened out beside the page that is being read.

A careful perusal of its pages has not led to the discovery of anything that we should call erroneous, but the author's commendable desire for brevity has resulted in certain definite statements being made which we should prefer to have seen qualified. For example, we are told that the value of scrap should be credited to each order, whereas the words "where possible" should have been added; we can conceive of many cases in which it is virtually impossible, without resorting to unwarranted additional labour—*e.g.*, the turnings from a battery of automatic machines. We should also have preferred to see tools subdivided into consumable, standard and special, and also a definite line of demarcation established between plant and machine tools. The general question of technical estimates is only allowed five pages, and we feel that much more might, with advantage, have been included on this important section.

Of the constitution of the forms, which naturally furnish the backbone of any costing system, there will probably be no concensus of opinion, and, accordingly, we may be forgiven if we suggest that there is a certain degree of weakness in some, in that essential information is not incorporated. As an instance, in Fig. 25, which deals with foundry stock, the cost of castings per pound at the various stages, the cost of fuel used, and other kindred costs are invaluable to the foundry manager. We should also have liked to see the author advocate the exploitation of the clock card, not only as an attendance register, but also as the labour record, and, finally, as the pay ticket of the operator. We are informed that books are preferable to cards for the purposes of costing. We are inclined to disagree, but admit that each method has inherent defects.

For the busy man who is anxious to study the subject of technical costs and estimates, with a minimum of reading, no better book can be suggested.

Les Combustibles Liquides. By M. Aubert, with Preface by Paul Sabatier. Pp. 368, with 57 tables and 60 illustrations. Gauthier-Villars et Cie., Paris. Price, bound in paper, 24f.

The author of this book has divided his work into four sections, dealing, first, with the general physical and chemical characteristics of liquid fuels; secondly, with the properties and applications of the naturally occurring fuels; thirdly, with the artificial liquid fuels; and finally, what is called in France the problem of a "Carburant national." M. Paul Sabatier in the preface emphasises the importance of the last-named subject, and points out that in all countries the same problem will sooner or later arise, owing to the exhaustion of the petroleum resources of the world.

In the four chapters which make up the first section of the book M. Aubert discusses in a general manner the identification and testing of liquid fuels, reserving the precise details of the methods employed for the chapters dealing with the various types of natural and artificial product. Included in this portion of the book is a series of physical constants, drawn either from recent technical literature or from unpublished results, which will prove of value to those engaged in the examination or identification of liquid fuels. The second portion of the book which embraces Chapters V. to VII. is devoted to the study of the simple distillation products of crude mineral oil, and in it the results are given of work carried out during the war upon rapid methods of identification and valuation of the more volatile constituents of the crude oil. In the third section we find a description of the methods in use for producing liquid combustibles by artificial means, and of the characteristics and properties of these artificially prepared liquid fuels. The cracking processes of Burton and Hall and the catalytic methods of Sabatier and Bergius are described, and the conversion of oils of animal or vegetable origin into petroleum is discussed. Finally, in Chapter X., the question of using alcohol as a fuel is debated, and the problem offered by the satisfactory combustion of mixtures of alcohol and benzol is considered in relation to the liquid fuel needs of France.

Railway Matters.

ONE of the passengers injured in the Haymarket collision of July 28th died last week. This makes the fifth death.

HULL City Council has decided to purchase 1558 tons of German tram rails, thus effecting a saving of £3000 on a tender of a Middlesbrough firm, which was recommended by the Tramways Committee for acceptance.

THE Swiss Federal Railway authorities, as a consequence of the serious fire that followed the collision at Bellinzona in April last, have prohibited any gas-lighted vehicles being run on their lines. It will be remembered that the fire mentioned broke out in a German sleeping-car that was lighted by gas.

THE arrest of the driver concerned in the Haymarket fatal collision of July 28th prompts the observation that there are no coroner's inquests in Scotland. As a consequence men who are liable to be charged with criminal negligence may remain for some time in suspense as to whether or not the police will take action. In England the verdict of "accidental death" at an inquest generally disposes of this point.

MENTION was made in this column on the 15th inst. of the retirement at the end of the year of Mr. C. F. Bengough, the chief engineer of the North-Eastern area of the London and North-Eastern Railway. Mr. Bengough is only sixty years of age, but in the last twenty-five of the thirty-four years he has been with the North-Eastern he has been district engineer of all the four divisions except Darlington and chief engineer of the whole system since the late Mr. Charles A. Harrison retired at the end of 1914.

A CONTEMPORARY reports the placing by the Great Western Railway Company of two important constructional contracts. The first, let to a local contractor, is for the erection of a large locomotive shed at Stourbridge, on which £118,000 will be expended. Coal and water will be stored above the new shed, enabling engines to fill their bunkers and tanks with the minimum delay. The second contract, placed with a Stroud firm, covers the erection of new goods and cable sheds at Evesham. These works are among those accelerated by the railway company at the request of the Government for the relief of unemployment.

ACCORDING to one of our electrical contemporaries, large electric railway schemes are in course of realisation in Poland. An engineering company of Posen, styled the "Tri," is to carry out the construction of the following lines:—(1) Dombrowa to Czenstochan and Lask, and thence to Zgierz, Kutno, Plock, Sierpe, and Brodnica, thus linking the Dombrowa coal basin with Pomerell; (2) from the Upper Silesian coalfield to Wielun and Kempen; (3) from the Dombrowa coalfield to Opocno and Warsaw, where a bridge over the Vistula will have to be erected. The capital for these lines will be partly subscribed by the French Société Générale d'Entreprise and partly by Polish companies. English financial help is also anticipated.

A SIGNIFICANT change has just been made in the general superintendent's department of the London, Midland and Scottish Railway. Mr. R. Killin, who was, before the grouping became effective, the general superintendent of the Caledonian Railway, became the general superintendent, passenger services, of the combined company. He now returns to Glasgow as general superintendent, Northern Division, and Mr. J. Ballantyne, who has been holding that position, becomes goods manager, Northern Division. We believe that the explanation for this change is to be found in the fact that the competition between the East and West Coast routes has become so keen that the authorities of the latter feel that they must have in Scotland the best man possible, and that they have in Mr. Killin.

THE railway statistics for the month of June, compiled by the Ministry of Transport, have recently been issued as a Stationery Office publication. The passenger figures were influenced by the fact that Whit-Monday came within the period reviewed, whereas in 1923 it was in May. The number of passenger journeys showed a decrease of 2.2 per cent. Actually, the decrease was more serious than this, as there were 5,000,182 fewer full-fare passengers than in June, 1923, but 2,735,848 more at reduced fares. The receipts, as a consequence, had a decrease of 5.9 per cent. The intensified competition, which has been so marked since grouping came into being, is shown by the passenger train-miles, with a reduction of 2.2 per cent. in the number of passengers, having an increase of 3.2 per cent.

INQUIRIES among the principal railway officers lead us to the conclusion that, as regards passenger traffic, they are enjoying an unparalleled prosperity. The receipts are higher than in the record year of 1913, and considerable difficulty is being experienced in finding sufficient rolling stock. The latter condition explains, in the main, the reason for the inconvenient overcrowding that is, unfortunately, now very general. The British Empire Exhibition has contributed greatly to the increased traffic, but, in addition to this, the general holiday movement has been much augmented. That the Exhibition is bringing considerable profit to the companies will be appreciated when it is remembered that not one of the hundreds of thousands brought to London every week is carried at less than the ordinary single fare for the double journey.

THE Ministry of Transport's freight train statistics for June last show that there were, when compared with June, 1923, increases of 29.5 per cent. in the tonnage of bricks carried by rail, of 13.2 per cent. in stone for road-making, and of 7 per cent. in iron and steel. Despite the reduction of rates made in August, 1923, the decrease in the freight receipts was only 0.9 per cent. As the tonnage increased by only 0.3 per cent. the traffic must have been more valuable or carried farther; in fact, the increase of 3.9 per cent. in the ton-miles shows the latter. This feature explains, too, the increase of 5.4 per cent. in the freight train-miles. The average train load had the small drop of from an average of 131¾ tons to one of 131¼ tons. Trains did not, however, get over the line as quickly; the net ton-miles per engine hour fell from 460¼ to 453¼.

Notes and Memoranda.

THE new coalfield near Coalisland, in Northern Ireland, is said to contain some 200,000,000 tons of fuel. There are ten seams, averaging 3ft. thick, at a depth of slightly over 1000ft. It is intended to work the seams at the rate of 100,000 tons a year.

A NEW industry, which it is anticipated will have far-reaching effects on the trade of Orkney and on the difficult problem of the disposal of coal dust at the pits, has begun at Stromness, Orkney. The company which is undertaking the work will produce from seaweed a binder for the manufacture of coal briquettes.

IN the course of a paper on the mineral resources of Canada, read before the Royal Society of Arts, Dr. C. V. Corless said it would seem possible that the vast pre-Cambrian area may in time become the greatest and most permanent single source of supply of the world's needs in the precious metals.

LARGE deposits of ore containing 67 per cent. of ilmenite have been discovered in the upper reaches of a small tributary of the Endau River, in the State of Johore, Malay Peninsula. The Endau is on the East Coast and flows into the China Sea. Samples have been sent to London for examination. Local analysis shows that samples contain 46.5 per cent. titanium oxide. It is thought that this mineral may be used in the preparation of a non-poisonous pigment to replace white lead.

A NEW type of insulator for high-pressure systems has been designed by Professor H. B. Smith, and was described at the recent convention of the American Institute of Electrical Engineers. The special feature of the insulator lies in the use of metal and wood. From a technical standpoint it is fundamentally sound; its questionable features are those associated with service conditions. The tendency for wood to carbonise has prohibited its use in the past, for any initial carbonisation originating from leakage, &c., tends to continue and spread. Professor Smith claims, however, that the impregnation process and design used will prevent any carbonisation.

THE 6¼in. copper steam pipe of a Liverpool steamer failed when at sea and caused the death of two firemen. The reason for the accident was, according to the official report, defective brazing in a repair. The pipe, near its end, had shown signs of failure, so the end was cropped off and a new end fitted on much like a spigot and socket joint. The repaired pipe was tested, hydraulically, to double working pressure, but blew out of the flange after a few days' service. It is pointed out in the report that sleeve joints are unreliable, and therefore unsuitable for steam pipes. There would have been very much less risk of failure if, after the pipe had been cropped, the flange had been brazed to the end of the pipe, and the original length of the pipe made up by a suitable distance piece or short length of pipe fitted with flanges.

CARBON black is a fluffy, velvety, black material produced by burning natural gas, with a restricted air supply, against a metal surface. It is, in fact, a species of lamp black, but possesses certain unique and valuable qualities that cannot be claimed for any other substance, and in consequence, as a commercial product, it is becoming of increasing importance. The chief qualities that distinguish it are its remarkable fineness, lustrous colour, freedom from grit, general adaptability as a pigment when mixed with oils, and toughening properties in rubber compounds. It is bulky—1 lb. to the cubic foot—and its handling, therefore, demands good transportation facilities. Its chief uses are as a filler in rubber compounds, printers' ink, black and grey paints and enamels, stove and boot polishes, phonograph records, buttons, typewriter carbon paper, glazed paper, crayons, tarpaulins, black leather, Chinese and India inks, insulating materials, and, in fact, in almost all articles in which a black filler is used.

IN the course of some recent tests made by the American Bureau of Standards, the effect of ultra-violet rays upon polished metal surfaces was observed by allowing the rays to play upon a small area of the surface, the remainder of the surface being shielded by a thin metal sheet. Specimens of Armco iron, medium-carbon steel, "stainless" steel and high-nickel steel were exposed for 18 hours to the ultra-violet rays, the result being a pronounced change in the exposed area. When the specimen is cooled and the moisture of the breath is allowed to condense on the surface, the exposed area becomes visible at once, the drops of condensation being larger than on the unexposed parts and the surface looking as though a thin film of oil had been spread over it, so that it is not wetted so easily as the rest of the surface. In the medium-carbon steel, very noticeable corrosion of the exposed spot occurred after four condensations of moisture, while the remainder of the surface was hardly attacked. Chromium and nickel steels did not show any corrosion, although the same difference between exposed and unexposed areas was noticed. The nature of the change produced by the ulta-violet light is not yet known.

THERE is reason to believe, says *Concrete*, that many engaged in concrete construction do not yet realise that the setting of cement gives rise to a considerable development of heat, and in consequence concrete itself becomes hot in the early stages of hardening. Fears are sometimes expressed that this behaviour is indicative of a hot or unsound cement, but this is not the case. The hardening of cement is a chemical process, and the more active the cement the greater the amount of heat units developed in a shorter time, and in consequence the temperature rise is higher. Some figures recently published in the United States show that a thermometer when inserted at 5 p.m. into a mass of freshly-laid concrete forming a bridge pier registered 46 deg. Fah.; at midnight the temperature indicated by the thermometer was 60 deg. Fah.; next morning it was 76 deg. Fah.; after three days it was 100 deg. Fah.; and after 15 days the maximum of 116 deg. Fah. was reached. The fact that such temperatures as these are possible in the interior of concrete emphasises the importance of keeping concrete moist for a fortnight after mixing, in order to avoid loss by evaporation of water needed for the setting process, and also to avoid contraction.

Miscellanea.

THE Plympton fire-engine, which dates back to 1765, was used recently to extinguish a blazing rick.

THE Government of Colombia proposes to expend 30,000,000 dollars on public works within the next three years.

THE first of the 1000 horse-power Napier-Blackburn torpedo-carrying aeroplanes for coastal defence purposes was launched from the Brough aerodrome on the 21st inst.

DURING last year the Sheffield electricity works generated 182,677,740 units, while 151,896,004 units were sold. The difference was accounted for by losses in transmission.

THE contemplated improvements to Quebec Harbour will involve an expenditure of 10,000,000 dollars, and of that amount 500,000 dollars has been voted for this year's programme.

THE Barnsley bed of coal has been reached by the shaft being sunk at Thorne Moorends by Pease and Partners at a depth of 921 yards. The shaft was started in 1909, but water and the war retarded progress of the sinking.

ON her last westward-bound trip the Mauretania did the voyage from Cherbourg to the Ambrose Channel in 5 days 3 hours 20 min., which represents an average speed of 25.6 knots, as compared with her previous best westerly trip at 24.78 knots.

THE Electricity Commissioners have submitted a special Order to the Minister of Transport, for confirmation, giving powers to the Brundall and District Service Company, Limited, to supply electricity in Brundall and other parts of the rural district of Blofield.

FOR the purposes of determining the deflection of Westminster Bridge, under its present abnormal loading, it is proposed to exclude traffic for about a quarter of an hour at three o'clock on the 26th. Observations will then be made consecutively with full load, no load and full load again.

THE Chilean Government is asking for tenders for the construction of improvements at the port of Lebu, involving an estimated expenditure of nearly £1,000,000. When the new works are finished, Lebu will be united to the central system of Chilean railways by a line, now under construction, to Los Sauces, which is the port of a coalfield with many important pits now in active operation.

WELL No. 4 of the Canadian Natural Gas Light, Heat and Power Company in the new Foremost field, near Calgary, has been brought in with a measured output of 20,000,000 cubic feet of gas daily, open flow, according to formal notice given the Alberta Public Utilities Board by the company. This makes the well the biggest of the group of four new producers in the field, and provides a total supply of gas at Foremost of 49,000,000ft., open flow measurement.

IN the Barberton district of South Africa a sedimentary bed has been discovered carrying a nickel ore of up to 25 per cent. The bed is, according to the *S.A. Mining and Engineering Journal*, up to 3ft. in thickness, and, though not yet developed, appears to be permanent in character. The ore appears to occur in the form of an entirely new mineral—a magnetic iron-nickel oxide. Sulphur is absent, and the mineral reduces easily and runs down into a metallic button carrying about 54 per cent. nickel.

THE following minerals have been discovered in the Belgian Congo close to the Rhodesian border by geologists of the Union Minière:—Cerussite or white lead ore, found associated with malachite; calamine, found occurring in beds and veins associated with galena and copper ores; and aurichalcite. The calamine is in places coloured green by the presence of aurichalcite, which is often isolated by thin beds where the mineral is concentrated. Another recent discovery is "fourmarierite," which dissolves easily in the acids with the formation of a gelatinous substance; the solution gives the reactions of uranium and lead.

A REPORT from San Francisco says every instrument known for the study of astronomy, comprising the most extensive equipment ever assembled in the United States, is being employed at the Lowell Observatory at Flagstaff, Arizona, and at the Lick Observatory, Mount Hamilton, California, during the remainder of August, while Mars is only 34,600,000 miles distant from the earth, the closest for 100 years. The observation is concentrated upon discovering whether life exists on Mars. Although Lowell reports favourably, the conditions at the Lick Observatory lately have been unfavourable. A full report is not likely to be forthcoming for several months.

IT is reported from Kingston (Ontario) that plans are under way for the building there of an immense new dry dock, to cost approximately £800,000 and to quadruple existing facilities. Kingston is one of the oldest cities in Canada, with a population of 22,000, and is situated at an important industrial, strategic position on the river St. Lawrence, where it joins Lake Ontario. The promoters intend that the new dock shall be completed and ready for operation at least by the opening, if not before, of the enlarged Welland Canal. Construction of the new dry dock will take at least three years. It will be 300ft. wide, 700ft. long, and will accommodate at the same time two of the largest vessels plying on the Canadian-American lakes.

THE two pioneer sandalwood oil refineries working at Bangalore and Mysore City utilised 750 tons of sandalwood cut from Mysore forests during 1923, as against 508 tons in the previous year. Oil sold during this period amounted to 149,630 lb., as compared with 115,028 lb. in 1922. According to a report by the United States Acting Trade Commissioner at Calcutta, both factories have made such good progress in the manufacture of a special grade of sandalwood oil suitable for the Japanese trade that this oil has now displaced the German product for that market. The prosperity of the industry is due to the efforts of the Mysore Government to exploit the vast forest resources of sandalwood found in the State and to manufacture a high-grade oil suitable for export markets.

EMPIRE EXHIBITION—SOME EXAMPLES OF LOOMS

(*For description see page 202*)

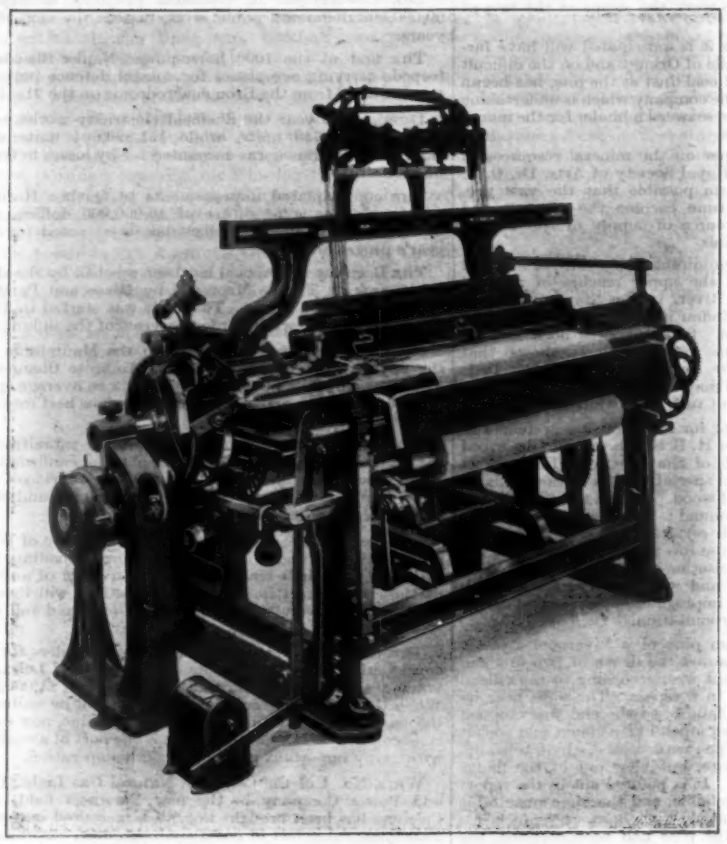


FIG. 369—SHIRTING CLOTH LOOM—COOPER BROS.

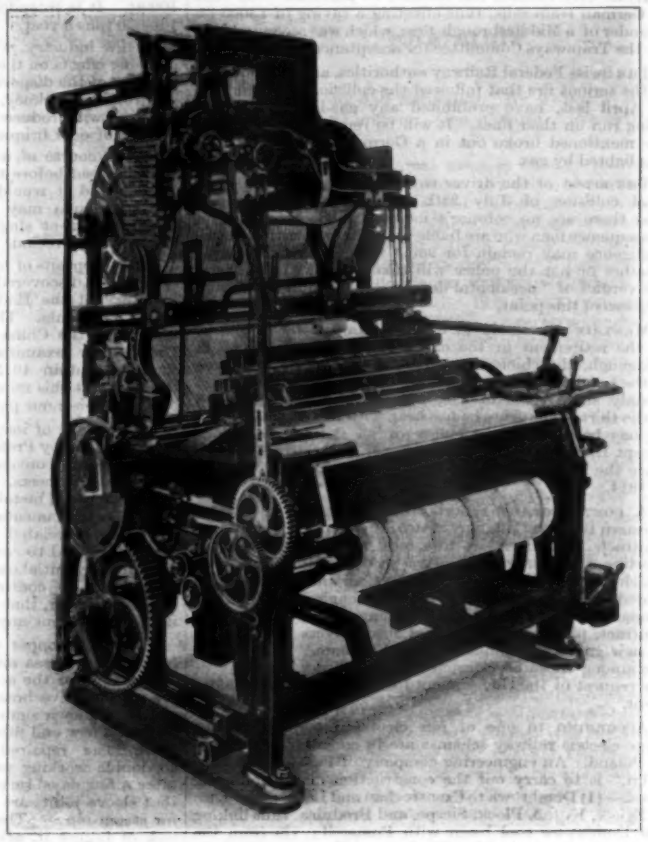


FIG. 370—TURKISH TOWEL LOOM—COOPER BROS.

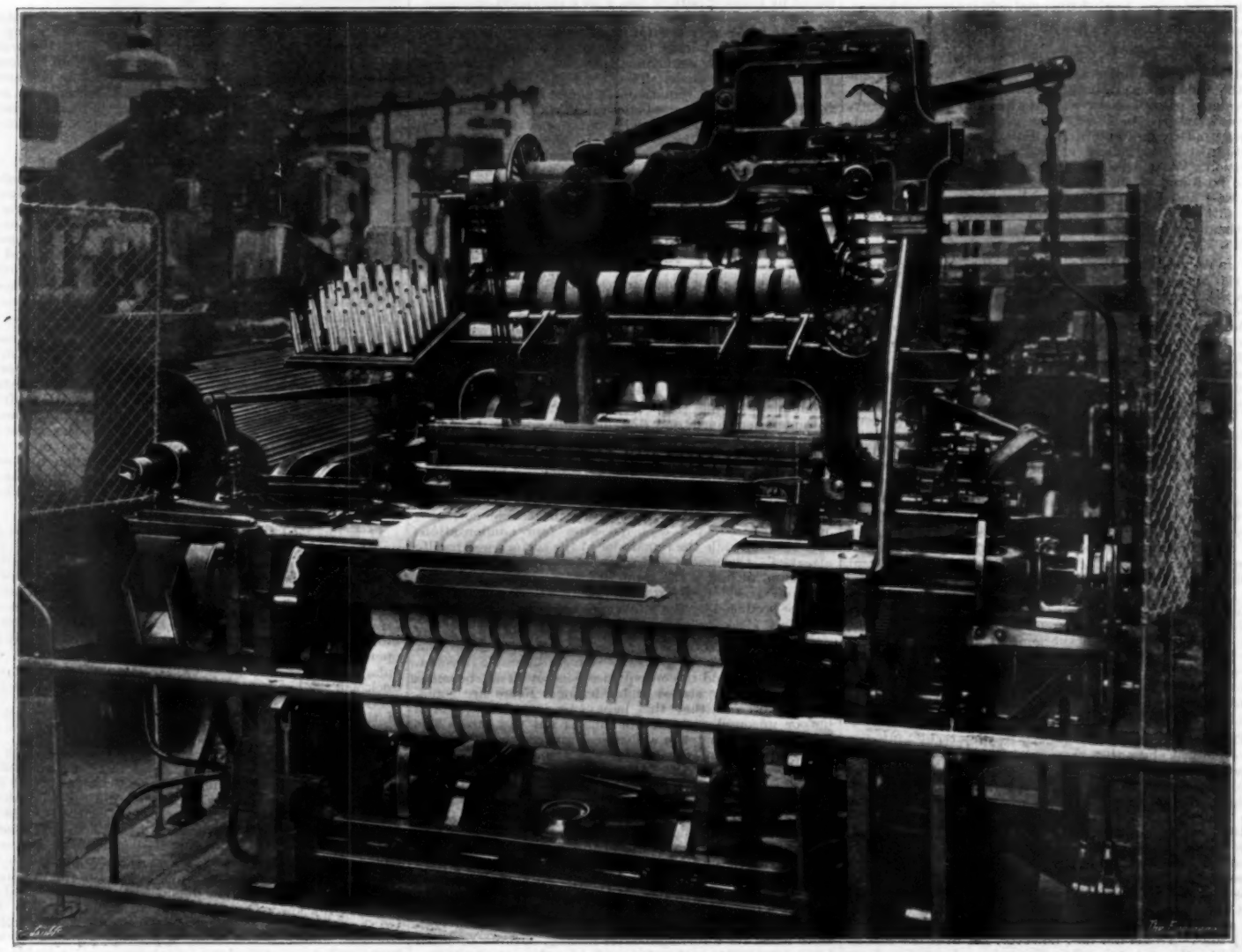


FIG. 371—SIX-SHUTTLE CIRCULAR BOX LOOM—GREGSON AND MONK

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THE ENGINEER.

AUGUST 22, 1924.

The Passing of H.M.S. Warrior.

Despite the hard materialism with which we of this age are credited, most of us have sufficient sentiment left to feel a reverence for objects which recall the triumphs and achievements of bygone days. Only a year or two since the nation was shocked by the news that unless remedial measures were taken forthwith, Nelson's flagship, the Victory, that relic of the most glorious page in our naval history, would fall to pieces through sheer decay. This tragedy has been happily averted, thanks to the generosity of the public, and, above all, to the loving care of Admiral of the Fleet Sir Doveton Sturdee and his little band of fellow-enthusiasts, who have so well succeeded in restoring the gallant old ship that she bids fair to remain intact for many more years to come. More recently still, the clipper Cutty Sark, the almost fabulous speed of which was the talk of the 'eighties, has been emancipated from the alien hands into which she had fallen, and is now once more an honoured though inactive unit of Britain's merchant navy, thanks to Captain Dowman, a public-spirited citizen, who has purchased the ship and partially re-rigged her. It remains to be seen whether a third vessel of unique historic interest will escape the destruction that threatens her. We refer to the Warrior, our first sea-going ironclad man-of-war, which has been serving for many years as part of the Vernon torpedo establishment at Portsmouth. She has now been placed on the disposal list, and must soon be sold to the shipbreakers unless means of preserving her can be found. In the course of an eloquent appeal on behalf of this ship, one of the Service journals points out very truly that "the Warrior was at once experimental, conventional, successful, and beautiful." Strictly speaking, she was not the first armour-plated ship to be constructed for the British Navy. That distinction belonged to the floating batteries of the "Thunderbolt" class, which were built during the Crimean War, and of which the nameship is, or was until recently in use at Chatham as a hulk. But beyond their ability to float, these batteries had nothing "shipshape" about them. They were simply mobile gun-carriages, not sea-going ships at all. France it was who led the way in developing ironclads of the latter type. In 1858 Dupuy de Lôme, the brilliant French constructor, took the Napoléon, a 91-gun screw line-of-battle ship, cut down the two upper decks, lengthened the hull by 23ft., and armoured it from bow to stern. The vessel thus transformed, re-named the Gloire, was, in fact, the first sea-going ironclad to be completed. Though by no means perfect, she possessed the supreme quality of being able to resist the explosive shells then coming into use, which foreshadowed the doom of the wooden warship.

Naval students of that day saw clearly enough that armour had become indispensable to ships destined to fight in line. In England, however, where the evolution of the Gloire had been watched with an interest not unmingled with alarm, the employment of wooden hulls for the purpose was never viewed with favour. There were sound scientific reasons for this attitude, as the French discovered to their cost, after devoting large sums to the conversion of ships which proved to be highly perishable and short-lived. When, therefore, the Admiralty decided in 1859 to build a counterpart to the Gloire, they gave preference to those designs which provided for an iron construction. Fourteen private firms submitted plans, all of which were ultimately set aside in favour of an Admiralty design, prepared by John Scott Russell and Isaac Watts, the Chief Constructor. The Warrior was laid down on May 25th, 1859, at the Thames Ironworks, Blackwall, a sister vessel, the Black Prince, being put in hand at Glasgow somewhat later. In those days they were justly regarded as mighty ships, for the Warrior was 380ft. long between perpendiculars and displaced 9210 tons. Her engines, built by Penn, were of the horizontal single-expansion type, developing on trial nearly 5500 horse-power and driving the ship at the then remarkable speed of 14.36 knots. On an endurance trial of six hours she maintained a mean of 13.9 knots. Unlike the French Gloire, in the "sullen, low-browed, graceless aspect" of which—to quote the words of Sir E. J. Reed—there was no hint of beauty, the Warrior had the handsome lines of a true frigate, her shapely stem concealing the ram, which was supposed to represent one of her most formidable powers of offence. She further differed from the French ship in not having a complete belt of armour, her 4½in. plating being limited to less than two-thirds the length of the hull amidships. Bow, stern, and steering gear were left unprotected, a serious deficiency which was repaired in our later ironclads. But in justice to her constructors it must be remembered that an essential feature of the design was high speed under all conditions of wind and sea. This necessitated the fining down of the extremities, which could not therefore be given armour protection, though both were minutely subdivided by horizontal, transverse and longitudinal bulkheads. On trial, and subsequently in service, the British vessel showed herself superior in speed to the Gloire. She had also better nautical qualities, though her enormous length rendered her difficult to manœuvre when sea room was limited. As completed, she carried an armament of forty-eight smooth-bore guns, firing 68 lb. shot and shell. This was changed later to a mixed battery of rifled Armstrongs and smooth-bores, and eventually to thirty-two M.L.R. guns of 8in. and 7in. calibre. For many years after her completion in 1861 the Warrior performed useful service in home and foreign waters, until at length she was assigned the honourable if prosaic duty of accommodation hulk at Portsmouth, where she remains to this day.

She was the forerunner of a long line of armoured frigates, some of greater, others of less dimensions, but all built of iron. It is to be regretted that motives of expediency—political as much as military—led the Government of the day to emulate French practice to the extent of improvising a number of ironclads out of wooden ships-of-the-line. The experiment was as much a failure here as it had been in France, and it was not long before these converted ships dropped out of the Navy List. No doubt they helped to swell the British total in contemporary returns of relative armoured strength, but they were rightly distrusted by a nation, the instincts of which have always been more or less scientific in that which relates to the material of naval warfare. In connection with the movement to preserve the Warrior as a national souvenir, we have seen her described as the prototype of the modern Dreadnought. She is that only in the sense of having been our first sea-going ironclad. In point of fact, the battleship of to-day owes nothing to the Warrior except its armour belt. It is far more the lineal descendant of the Devastation of 1869, the design of which was influenced, if not directly inspired, by the American monitors of the Civil War, as Sir E. J. Reed acknowledged in one of his numerous works on the subject of naval architecture. For all her excellent qualities, the Warrior was of a conventional type, save with regard to the material of which she was built and the addition of an armour belt. The "Admirals" of the 'eighties, the "Majestics" of the succeeding

decade, and the "Dreadnoughts" of the present century were all of them logical developments of the mastless turret ship Devastation. We do not believe that any earnest student of man-of-war design will challenge this assertion. It is as a triumph of ship construction *per se*, as well as of marine engineering, that we are entitled to hold the Warrior in high esteem, and for that reason we echo the hope of our service contemporary that the vessel may be saved from the tender mercies of the shipbreaker. We fear, however, that it will be difficult to move public opinion to the requisite degree of interest in a ship to which fortune never vouchsafed a baptism of fire, and whose very name —long concealed under the official designation of "Vernon (No. III.)"—is unknown to the majority.

The Position of British Shipbuilding.

Evidence accumulates week by week that the home shipbuilding industry is in the throes of more difficult conditions than have been experienced for a generation. The position of affairs which was outlined once more at last week's launch at Clydebank has now become familiar through reiteration, and it is common knowledge that the percentage of unemployment is still higher in shipbuilding than in any of the other great industries of the country. It is not merely that owing to the conditions which prevent a recovery in world trade there is a surplus of shipping for present requirements, and that shipowners have no inducement to place orders except to fill definite requirements in vessels of special types, but that the comparatively high costs of production in British yards have led to keen competition from continental builders for new tonnage contracts. Foreign yards have, indeed, as we have from time to time reported, succeeded in some instances in diverting orders from home shipbuilders, and in spite of the efforts made to minimise the importance of this fact, it is a definite break with old tradition of a somewhat disquieting character. The significance of this latest development in shipbuilding is deepened by the knowledge that it follows on an almost complete loss of orders from foreign shipowners for British yards, which in pre-war years represented 20 per cent. of the total output of the home industry. The percentage of foreign work in the tonnage under construction in British shipyards is now only 3 per cent., and the difference between the two figures of 3 and 20 per cent. represents a serious loss of work to home industry. The disinclination of shipowners in other countries to fill their requirements in British yards is based, not only on considerations of price, but on war-time developments. It was necessary for the maintenance of sea transport during the period of hostilities to expand shipbuilding resources, both at home and abroad, and it is natural that the larger shipbuilding capacity of foreign yards should be used for supplying the needs of foreign shipowners. That state of affairs will persist; one of the great lessons of the war was the importance of linking with the possession of a merchant fleet a strong shipbuilding industry, and by this development all the great maritime nations have been placed in a position of independence for new tonnage requirements.

Home shipbuilders are probably reconciled to the loss of the foreign market in shipbuilding, but in spite of the fact that for various reasons, largely associated with questions of price, repair work on British ships has gone abroad, they were not prepared for the invasion by foreign shipbuilders of the new ship market for British owners. The suggestions which have been put forward that shipowners who have accepted low quotations for ships to be built in Dutch yards will be buying an inferior article can be dismissed; those who are familiar with the Dutch shipbuilding establishments know that in lay-out and equipment, management and other facilities for the production of sound work, those yards are not inferior to those of the Clyde or the North-East Coast. It is, however, possible to face the unpleasant fact that foreign yards have become serious competitors for work on account of British shipowners without sharing the alarmist opinions which have found expression in certain quarters. The placing of orders abroad may be regarded as a temporary phase of a difficult situation. British shipowning companies as a whole will remain loyal to the home industry. They recognise that the relations between British shipowners and shipbuilders are rather those of allies than of buyer and seller. Price differences may tempt a few owners to fill their needs in foreign yards; but the great shipowning interests of the country realise that, taking a long view, the supremacy of the British mercantile marine is bound up with the existence of a prosperous shipbuilding industry. British yards will therefore continue to enjoy a right—based on mutual self interest—to orders from British shipowners, and are practically assured of large replacement contracts in the comparatively near future. The task which awaits the home industry is that of carrying on until conditions warrant shipowners in embarking on the capital expenditure involved in the process of substituting new ships for tonnage which, judged by the modern standard, has reached the stage of obsolescence. The policy adopted by home shipbuilders of accepting work at prices which, as the figures submitted to the Industrial Court showed, have resulted in heavy losses, cannot be continued, and the situation is complicated by the fact that wages increases have been awarded, and that the tendency is for shipbuilding costs to reach a higher rather than a lower level. Nor is it, apparently, possible in Great Britain or in Ireland for the wages percentage in total shipbuilding costs to be reduced, as has been done in foreign yards, by an acceptance on the part of workers of longer hours or by the relaxation of restrictive trade union rules and regulations. Only by improvements on the technical side, both in design and in the materials employed, is there any immediate hope of effecting economies which would reduce the costs of ship construction in home yards. It is satisfactory to learn therefore that certain lines of advance are being marked out. There are good grounds, indeed, for the claim that, except for the reluctance of the labour element to co-operate in measures for the revival of the industry, there is nothing wrong with British shipbuilding. When the necessary deductions are made for the lower wages, longer hours, advantages in certain cases of exchange and in others of State or municipal aid, which confer advantages on foreign yards, home establishments can still claim the reputation for building the best and cheapest ships in the world. There is nothing in the present state of the industry which could not to be remedied, and it is to be hoped that in the new series of negotiations between the Shipbuilding Employers' Federation and the big shipyard unions, with which a beginning has been made, means may be found of putting the industry on its feet.

The times are admittedly out of joint, but a careful study of the statistical position suggests that only a moderate revival in world trade is necessary to usher in the beginnings of active conditions in the shipyards. The British mercantile marine contains a relatively low percentage of ships less than five years' old, as compared with the merchant fleets of other nations, notably that of Germany, and British shipowners will not hesitate to bring about an improvement in this respect by large replacement orders when signs of a real recovery in shipping are apparent. A slight improvement in the position was shown in the tables for the June quarter of 1923. The tonnage launched from home yards—864,500 tons—was the highest recorded for a similar period for the last two and a-half years, and completely eclipsed the performance of foreign yards. The quantity of shipping under construction at the end of June in Great Britain and Ireland was 1,465,000 tons, against 960,000 in the rest of the world's yards, and there were laid down in home establishments over 375,000 tons of new ships, out of a world total of new work begun of 619,186 tons. From this test the home industry emerges with credit. Concurrently with this indication of returning confidence in the future of shipping, there has been an increase in the mortality of existing ships. The statistical summary of ships totally lost, broken up, condemned or otherwise disposed of, shows that during the past two years over 2,500,000 tons of shipping have been removed from the Register. The process of disposing of obsolescent tonnage was considerably expedited during 1923, and has since proceeded at an accelerated rate. The activities of the shipbreaker are an obvious preliminary to improved conditions in shipbuilding. Another feature of the situation which is indicative of better times is the advance made by the motor ship, which now represents nearly 50 per cent. of the tonnage under construction. No doubt now remains as to the economy for many classes of service of the marine internal combustion engine, in comparison with the steam engine, and even the higher initial outlay associated with the motor ship and the uncertainty which still exists as to the proper allowances for upkeep and depreciation, have not prevented a rapid increase in the number of motor ships in service. In these difficult days, it is essential, if the shipowner is to offer effective competition in the arena of sea transport, that he should possess the most efficient type of ship. The motor ship will in many cases fill that requirement, and a revolution in type of propelling equipment for ships almost as great as that when steam supplanted sail is now upon us. In this development British shipbuilders and marine engineers, although somewhat late in entering the field, are likely to assume the same dominant place as in steamship construction, and in the building of motor ships, quite apart from all other considerations, lies the promise of long-sustained active conditions in the British shipbuilding industry.

One Hundred Years of British Railways.

No. VIII.*

PART I.—THE STOCKTON AND DARLINGTON RAILWAY AND ITS PREDECESSORS.

THE CONSTRUCTION AND OPENING OF THE STOCKTON AND DARLINGTON.

It is fitting that this article should open with the observation that the seal of the Stockton and Darlington Railway bore the motto "*Periculum privatum utilitas publica*" (at private risk for public service). The phrase applied not only to the first public passenger carrying railway, but to all those constructed in Great Britain since, which represent to-day a capital of over one thousand million pounds.

It has already been stated that the Stockton and Darlington obtained its Act in April, 1821. It gave powers for making and maintaining a railway or tramroad from the river Tees at Stockton to Witton Park Colliery, south-west of Bishop Auckland, together with several branches. It has also been said that Thomas Meynell was the first chairman, that Edward Pease, because of the stake he had in the concern, held the predominant position, and that George Overton made a survey of the line.

Pease had little confidence in Overton; possibly he preferred a northerner. Anyway, he got into touch with George Stephenson, of whom he had probably heard because of the railways the latter had built and the improvements he had effected in locomotives and track in Northumberland. Stephenson, accompanied by Nicholas Wood, went to see Pease on April 19th, the day the Bill received the Royal Assent.

Thomas Meynell also took some action. Through Mr. Mewburn, a solicitor of Darlington, he had made the acquaintance of Robert Stevenson, of Edinburgh, who was an authority on roads and who, in 1818, established a reputation as an engineer of railways by his report on a proposed railway from the coalfield of Midlothian to the city of Edinburgh. Stevenson saw Pease and Backhouse and subsequently made certain recommendations.

On what point or points Stevenson gave advice we do not know, but in view of the fact that in the report, just mentioned, he recommended the "edge rail" in preference to the "plateway," it was probably in relation to the question as to whether the new line should be a railway, laid with edge rails, in preference to a tramway, *i.e.*, laid with "plate rails." The former was, also the advice of William James.

The sequel was that on July 25th Pease wrote to George Stephenson and sent him copies of certain resolutions passed at a general meeting then recently held. They were:—

(1) That, on the best information this meeting has been able to collect, a railway be adopted as preferable to a tramway, and that land sufficient for a double railway be purchased as soon as the precise line is definitely settled.

(2) That the sub-committee write to George Stephenson to ascertain his charge for furnishing the information required by the third resolution.

(3) That in order to settle the line George Stephenson be in the first instance employed to survey the one laid out by George Overton . . .

Stephenson made his survey and reported on January 18th, 1822, that the route chosen was satisfactory, but that, by the introduction of gradients, cuttings or tunnels could be avoided and straighter lines obtained. His scheme, Stephenson admitted, would render necessary the use of machinery; in fact, he is found to be writing to William James on December 20th, 1821, that "we fully expect to get the engines introduced on to the Darlington Railway." On January 22nd, 1822, Stephenson was appointed engineer to the company at £660 a year. On May 23rd following, the first rails were laid—at Yarm—by Thomas Meynell.

We must now refer to William James, who, ever in search of men and material to advance a great scheme for the transport of passengers, had been to Killingworth and to Bedlington. The date of this visit cannot now be ascertained, but it was prior to June 22nd, 1821, as on that date James wrote a letter to one of the Stockton and Darlington directors. This letter, preserved in the Railway Collection of New-

* No. VII. appeared August 15th, 1924.

castle Public Library, spoke of the railway at Bedlington—built of Birkinshaw's edge rail—as the best he had ever seen both in respect of its material and its form. It also said:—"Although my letter is, to you and Mr. Pees (Pease) and his friends, of a private nature I feel it due to the characters and talents of the Northumbrians to declare that, in the sciences of mining and mechanics, we can, in the South, in no respect be compared with them and with such great and noble-minded men as Mr. Blackett and Mr. Buddle, and such abilities as Mr. Stephenson's and Mr. Chapman's. I cannot conceive my observations deserving of any other notice than to show how sensible I am of the value of these gentlemen and of the esteem in which I hold the plans and characters of yourself and your friends in Durham."

The diaries of William James show that in the autumn of 1821 he went to Darlington and saw Edward Pease. The writer—given only in the initials "E. M. S. P."—of "The Two James's and the Two Stephensons" (1861) said that these gentlemen were well known to each other and that it was doubtless at the desire of Pease that the meeting took place. Unfortunately, this statement cannot be corroborated, but there is no reason to doubt it and every reason to believe it to be true. William James had, at that time, more knowledge of railways than any other man living—his selection by Joseph Sandars the following year to survey the route for the Liverpool and Manchester Railway was proof of this—and Edward Pease had risked ten thousand pounds. No wonder, then, that the latter should welcome a talk with James.

The enthusiasm of James over the Stephenson locomotive when he met Edward Pease can probably be imagined. Thus the mind of the latter had already been influenced in its favour when Stephenson, on January 18th, 1822, made the report, already mentioned, as to the route of the line, wherein were recommendations which could only be met by the use of machinery. On November 18th of that year the Hetton Railway—between Hetton Colliery and Bishopwearmouth, a distance of 7 miles—was opened. The line was laid out by Stephenson and he was working on it when Pease sent for him. It was worked by five self-acting inclines and locomotives, and the Stockton and Darlington people had, therefore, near at hand examples of the use of machinery as suggested by Stephenson. The result was the lodging, for the session of 1823, of a Bill for the deviations recommended by Stephenson; for powers to work the railway by locomotive engines; and—another afterthought—*for the conveyance of passengers upon and along the same roads.* These powers were sanctioned by 4 Geo. IV., c. 33, which received the Royal Assent on May 23rd, 1823. On the point of the afterthought as to the conveyance of passengers it may be remarked that in the letter of July 28th, sending the resolutions to Stephenson, Pease spoke of the proposed railway as "a great public way and to remain as long as any coal in the district remains." It is noteworthy that there is no trace as to who suggested that powers to convey passengers should be obtained. Is it not likely that James inspired this also?

The whole of the main line, 28 miles in length, had a double track, whilst the branches, of an aggregate length of 12 miles, were single. There were, in addition, passing places or sidings on the main line of a total length of between 3 and 4 miles. The line started at the Phœnix Pit of the Old Etherley Colliery at the foot of Etherley Ridge. Up the North Incline of this ridge 1100 yards in length and on a 1 in 33 gradient, wagons were drawn by a fixed engine in the engine-house at the top of the bank. Two engines, each of 15 horse-power with cylinders 22in. diameter, were employed to work the drum. The South Bank, nearly a mile in length and on a gradient of 1 in 30¾, was worked by a self-acting incline. At its foot was the West Auckland turnpike road. At a distance of 1¼ miles thence came the West Bank of the Brusselton Incline 1850 yards long on a gradient of 1 in 33½, up which trains were worked by another stationary engine. There were two engines here also, each of 30 horse-power with 30in. cylinders. The East Bank was 825 yards long, fell 1 in 30¼, and was worked by a self-acting incline. At the foot of the latter the line was 383ft. above the quay at Stockton. From the end of Brusselton East Bank it fell 1 in 144 for 1 mile, 1 in 128 for 1¼ miles, 1 in 528 for 2¼ miles, 1 in 135 for 1¼ mile, 1 in 325 for 1 mile, and 1 in 135 for the 1¾ mile thence to Darlington. The next 3¼ miles were almost level and were followed by 1¼ mile of 1 in 204, 2 miles almost level, 1¼ mile of 1 in 253, ¾ mile of 1 in 226, 1 mile of nearly level, and 1¼ mile of 1 in 104. The average gradient for the 20 miles from Brusselton East Bank was 1 in 286 falling.

The rails were of malleable iron of the fish-bellied Bedlington type—Fig. 4 of Article VI.—12ft. and 15ft. long, weighing 28 lb. per yard. They were 2¼in. wide across the top, 3¼in. deep at the centre, and 2in. at the ends, and had a web ⅜in. thick under the head, tapering to ¼in. thickness. They were laid in a chair weighing 6 lb., which had a hole through each cheek. The rail had a corresponding hole at each end, and through the three holes was inserted a round-headed bolt, the point of which was hammered down to keep it in position. Some cast iron rails—about 25 per cent.—were laid down, but Joseph Pease told the 1839 Select Committee that they were taken up because it was found that they were liable to break as the speed increased.

The sleepers between Stockton and Darlington were oak blocks; beyond Darlington, because they were cheaper than oak, stone blocks were laid. Some of the latter, still *in situ*, can be seen on Etherley North Incline. They were laid square and not diagonally, as was the, perhaps later, practice.

There were two bridges over waterways. One, which crossed the river Gauntless between Etherley and Brusselton, was a wrought iron girder bridge of four spans, and there can be no doubt that it was the first iron railway bridge in the world. It was illustrated in THE ENGINEER of September 24th, 1875. The other bridge was over the river Skerne near Darlington, and was a single arch of stone.

It was not until September 16th, 1824, that two locomotives were ordered, at a cost of £600 each, from Robert Stephenson and Co. The names they bore were Locomotion and Hope. A number of wagons were also ordered, and when the line was opened Locomotion and 150 wagons had been delivered. Only one carriage was built. It was the Experiment, in which the directors and their friends rode on the opening day.

The work was mainly delayed by the difficulty in obtaining land; in most cases the value had to be assessed by a jury. The line was eventually completed, except some portions of the branches, and opened, on September 25th, 1825, with appropriate ceremony by a special train made up as follows:—Engine Locomotion, driven by George Stephenson, tender, six wagons laden with coals and passengers on top of them, one wagon laden with flour, passengers among the sacks; one wagon containing surveyors and engineers; Experiment coach, with directors; six wagons filled with visitors; fourteen wagons containing workmen; six wagons containing coal, passengers on top of them.

The company subsequently allowed the owners of coaches to run their vehicles on the rails on payment of tolls, and did not until April 7th, 1834 itself carry passengers. It did not even favour the carriage of goods, but confined itself to mineral traffic. In his evidence before the 1839 Select Committee, Joseph Pease said the railway began with small trains, chiefly drawn by horses. It had one or two locomotive engines, which did nineteen-twentieths of the work. Anyone had power to use horses, but few did so.

Letters to the Editor.

(We do not hold ourselves responsible for the opinions of our correspondents.)

STEAM *V.* ELECTRICITY IN PUMPING STATIONS.

SIR,—The British manufacturer is always believed by the politicians to be an extremely stupid individual. Your readers will have observed a paragraph in the speech which the Chancellor of the Exchequer delivered in the House of Commons on July 30th, in which, dealing with unemployment schemes, and particularly with the electrical industry, he says, "Another reason why electrical development was backward in this country was the failure of the industrialists themselves to appreciate the value of it," and then he goes on to tell of a foreigner who made an offer to a number of our large manufacturers to re-equip their works with electrical machinery on the principle of payment by results, but who could not get a single English firm to accept the offer.

It seems to be an axiom of politicians that power in the form of electrical energy is superior to all others, and in many instances, owing to its convenience, this is no doubt the case, as the rapid growth of electrical generators during the past ten or a dozen years has shown, but after all every case must be considered on its merits. Dealing with the particular product with which our own firm is concerned, *i.e.*, pumping machinery, and supposing that, as is usual in this country, coal is the source of power, it appears to be the reverse of the fact.

A good pumping engine will turn out 1 horse-power per hour measured in water lifted with an expenditure of 11 lb. to 12 lb. of steam having a pressure of 180 lb. and a superheat of from 100 deg. Fah. to 150 deg. Fah. The corresponding coal consumption would, of course, vary according to quality and other circumstances, but may be taken as from 1¾ lb. to 2 lb., and it must be remembered that, unlike the turbo-alternator sets, the consumptions of which are from time to time published, the steam pumping engine works its own air pump and other auxiliaries, *i.e.*, for about 2 lb. of coal the waterworks engineer can obtain a horse-power in water lifted, the actual product which he sells.

The Electricity Commissioners report for the year ending March 31st, 1923, states that the total units generated during the year by 240 local authority undertakings was 2,930,939,209, and that for this purpose 3,769,052 tons of coal and coke and 9214 tons of oil fuel were consumed, a total of 3,778,266 tons, while the corresponding figures for 186 company undertakings were 1,641,172,529 units, 1,772,349 tons of coal and coke, and 35,773 tons of fuel oil, a total of 1,808,122 tons. These figures are equivalent to a consumption of fuel per unit generated of 2.88 lb. for the local authority undertakings and 2.42 lb. for the company undertakings, and these figures do not represent the full amount of fuel used, as the Commissioners state that the units given are inclusive of those generated by town's gas, waste heat and water power, which, however, they say are only a small percentage of the whole.

But it will be noted that the units named are units generated, so that to ascertain the fuel consumed per unit delivered to the user a very considerable addition must be made, and it is probable that the actual fuel consumed per unit delivered would not be less than 3 lb.

The best electrically-driven pump of which we have trial results gave an overall efficiency pump delivery as compared with electrical input of just over 84 per cent., but this was a high-pressure pump, and for ordinary work an efficiency of 75 per cent. water delivery compared with electrical input may be taken as an excellent figure. On this basis coal per water horse-power would be practically the same as coal per electrical unit, say, as above arrived at, 3 lb.

Even if by the elimination of the smaller and worse-equipped stations greater economy is obtained, it is unlikely that the fuel consumption per actual horse-power in water delivered can be reduced to less than the consumption of a good pumping station, while, and this is the really important point, power at the pumping station is generated where it is wanted, while that produced at the central electricity station has to bear the very heavy cost of transmission and distribution mains which absorb a large capital and involve correspondingly heavy annual charges.

There seems, therefore, no doubt that for main pumping station work the general adoption of central station electric drive would not result in any saving of the nation's fuel stores and would involve a large addition to the money cost of the work done.

Another obvious consideration to which the present threatened electrician's strike very forcibly draws attention, is the danger of putting too many eggs in one basket, but this is outside the scope of the present letter.

For HATHORN, DAVEY AND CO., LIMITED.
REGINALD H. LUPTON, Director.

Leeds, August 14th.

100 YEARS OF BRITISH RAILWAYS.

SIR,—I have read with much interest the articles "One Hundred Years of British Railways" now appearing in THE ENGINEER, and especially the article No. VI., which appeared in your issue of August 8th, and on which I should like to make a few comments.

With regard to the gauge of Outram's plate ways, James Anderson's "Recreations in Agriculture," 1799–1801, already referred to in these articles, gives Outram's own gauge measurement as 4ft. 2in. between the upright flanges of the rails.

There is at least one instance of the use of cast iron edge rails, between Jessop's rails of 1789 and 1816, namely, the Middleton Colliery Line, when Blenkinsop's locomotives started to work on it in 1812.

I believe that Birkinshaw's first wrought iron rails, of 1820, were parallel, and that the first fish-bellied form was not rolled until later, probably those for the Stockton and Darlington Railway in 1825.

There are early stone block sleepers which are only 12in. × 15in. × 9in. thick, while those of the Surrey Iron Railway measure about 15in. square. Later stones were 18in. square, while those on the Stockton and Darlington line measured 18in. × 12in. × 8in. deep. The Liverpool and Manchester Railway blocks were about 24in. square and nearly 12in. deep. All these blocks were placed square to the rails, and the diagonal position was not adopted until later. Whether the change of position was the result of the experience on the Liverpool and Manchester Railway is not certain; but the London and Birmingham Railway appears to have been the first which adopted the diagonal position from the start. I am inclined to think that stone blocks were used mainly on account of their weight and durability.

E. A. FORWARD.

Surrey, August 14th.

UNSAFE ELECTRICAL EQUIPMENT IN MINES.

IN a recently published memorandum, the Bureau of Mines of the United States Department of the Interior points out that the use of open type electrical equipment, which fails to provide safeguard against the transmission of sparks and flame to gaseous and dusty atmospheres in coal mines, constitutes a real menace to the miners. Records of the Bureau covering twenty-six coal mine disasters and fires brought about by unsafe electrical apparatus show the loss of 500 human lives in addition to great damage to property. It is pointed out that an open type electrical coal drill used in a gaseous mine in West Virginia was the probable cause of the death of 27 miners; that a "half-safe" type of electric coal-cutting machine used in a gaseous mine in Pennsylvania was probably the cause of the death of 36 men; and that an unapproved, unsafe type of flame safety lamp, used in a gaseous and dusty mine in Utah, was the alleged cause of the death of 171 men. All three disasters happened within the past six months, and would seem to have been avoidable if proper equipment had been used.

Electric current can, it is explained, cause accidents in coal mines in five general ways:—(*a*) by shock to persons; (*b*) by igniting powder; (*c*) by igniting gas; (*d*) by igniting coal dust; and (*e*) by setting fire to inflammable material, such as timber and coal. A great many accidents from these causes are preventable if proper care is taken. Most of the accidents caused by sparks and flashes from electrical apparatus would not take place if electrical equipment tested and formally approved was used, and the Bureau states that so far as known, up to the present time, no disasters have been caused by sparks or flashes from equipment having its approval.

During the past fourteen years the Bureau has, in co-operation with manufacturers of electrical machinery and equipment for mines, conducted thousands of tests on various machines and apparatus submitted by the manufacturers to determine whether the device is safe for use in explosive mine atmospheres. If the machine or any part of it is not safe, the Bureau and the manufacturer work together to eliminate the unsafe features. When the machine finally passes the Bureau's tests it is formally approved for use in coal mines where hazards from gas and dust occur. Several classes of equipment have been tested, and there is a steadily growing list of approved equipment recommended for use wherever such equipment is needed.

Following recent disastrous coal mine explosions in different States, it is understood that more rigid requirements relative to electrical installations in mines will be enforced in West Virginia. A committee of State mine inspectors has made definite recommendation of a similar nature for improving the conditions in the Pennsylvania mine in which the explosion referred to occurred. The Industrial Commission of Utah has already issued new orders which will prevent the use of unsafe mine lamps in that State.

THE HENDON-EDGWARE EXTENSION OF THE LONDON ELECTRIC RAILWAYS

FIG. 1—HENDON CENTRAL STATION AND ENTRANCE TO TUNNELS

FIG. 2—THE LINE NEAR COLINDALE STATION

The Hendon-Edgware Extension of the London Electric Railways.

THE extension in a north-westerly direction of the London Electric Railways, begun by the opening on November 19th last of the line from Golder's Green to Hendon, was completed on Monday, the 18th inst., by the putting in service of the line from Hendon to Edgware. As a complement to these additions, there may be mentioned the Camden Town Extension which joined the Golder's Green—also the Highgate—line with the City and South London, opened on April 20th. During the remainder of the reconstruction of the latter railway—*i.e.*, between Moorgate and Clapham Common—the City and South London is only served as between Euston and Moorgate, but the reconstruction is nearly completed, and trains will then be run between Edgware and Highgate in the north-west to Clapham Common on the south. About a year later, the Morden Extension will be finished, and the passenger will then be able to continue his journey southwards to Wimbledon and Morden. There may also be noted, as part of the additional facilities being afforded by the London Electric Railways Company, the extension of the Edgware and Highgate–Charing Cross lines by a new tube under the river to its own station at Waterloo, and thence to Kennington, where, besides the connection at Camden Town, another junction will be made with the City and South London line.

The distance from Hendon to Edgware is 2 miles 79 chains, and there are intermediate stations at Colindale (1.31 miles) and Burnt Oak (2.21 miles from Hendon). Both have island platforms, 350ft. in length, with the station buildings at road level, whence the platform is reached by an overbridge and steps. Colindale—the station nearer Hendon—has at the north end a reversing siding between the main lines, which is entered by facing points in the north-bound line and left by trailing points in the south-bound, an arrangement which will allow for certain trains to run forward beyond Hendon and serve Colindale without going the whole length to Edgware. The last-named station has two platforms, but trains can arrive at and depart from either.

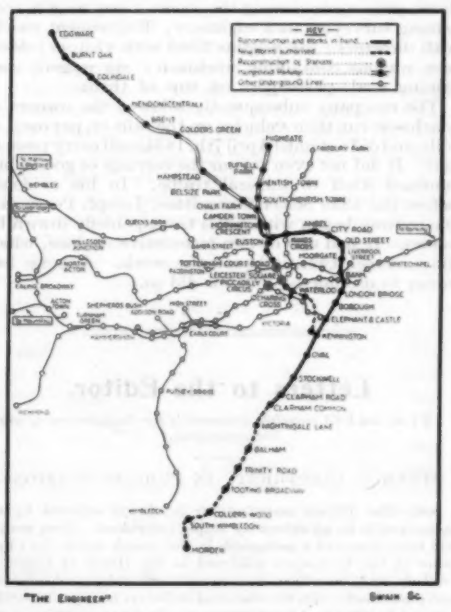


FIG. 3—MAP SHOWING THE HENDON-EDGWARE EXTENSION

The outstanding engineering features of the extension are the twin tunnels, 5 furlongs in length, immediately north of Hendon Station. The Midland section of the London, Midland and Scottish Railway passes over at the north end of the tunnels, and at one point is only 8ft. above the lining of the tunnels. Driving was commenced at the northern end, and the first 400ft. was executed by hand; the remainder being removed by rotary excavators. The amount of material taken out was 30,000 cubic yards. The tunnels are of the usual tube type of construction, having an internal diameter of 11ft. 8½in., and have required 6400 tons of cast iron segments, which, at and near where the Midland lines pass over them, are embedded in concrete.

The signalling is automatic, daylight colour signals being used. At Colindale and Edgware the points are operated by alternating-current electric point mechanism. Telephones are provided at all stop signals, and allow for motormen at once to get into communication with the signal-box should they wish to do so. The tunnels are equipped with telephonic facilities throughout. Adjoining Edgware Station is a car shed, 402ft. long, 69ft. wide, with four inspection pits, and accommodation for twenty-eight cars. The station itself is roofed over completely, so that it, too, may be used for storing cars at night if necessary. The exterior to the station and the public approach are tastefully and usefully designed. The contractor for the construction of the line was the Foundation Company, Limited. The consulting engineer has been Mr. Harley H. Dalrymple-Hay, with Mr. E. A. Ogilvie as the resident engineer.

For supplying current to the line a new automatic sub-station has been put into operation at Burnt Oak. With the exception of the main and auxiliary transformers, which were supplied by the Metropolitan-Vickers Electrical Company, the whole of the plant, consisting of two automatic equipments was built by the British Thomson-Houston Company

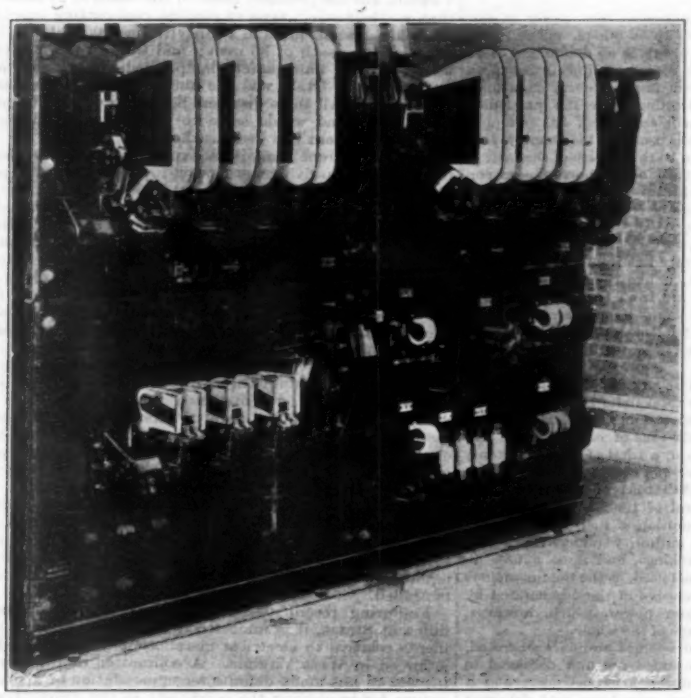


FIG. 4—MACHINE ALTERNATING-CURRENT CONTROL PANELS

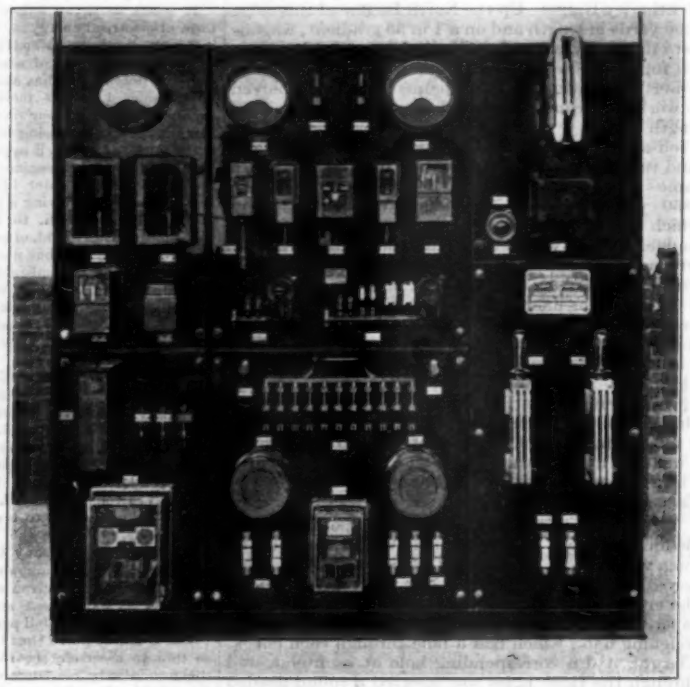


FIG. 5—MACHINE CONTROL PANELS

of Rugby. As we shall be publishing in an early issue a full technical description of the automatic sub-station shown on the British Thomson-Houston Company's stand at Wembley, we need not enter very deeply into details here.

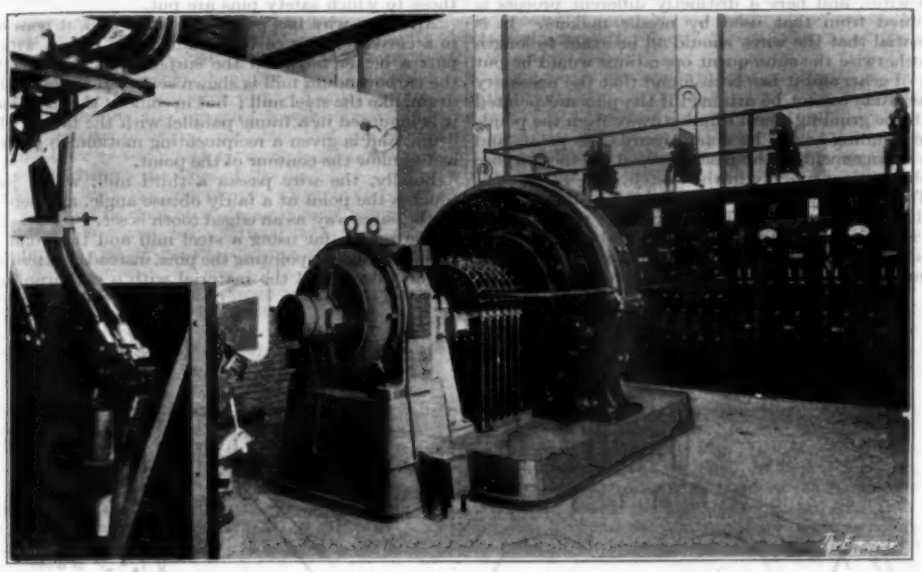


FIG. 6—1200-KILOWATT ROTARY CONVERTER

A three-phase high-tension supply at 10,500 volts and at a periodicity of 33⅓ cycles is taken from the Underground Company's power station at Lot's-road, Chelsea. The current is supplied to the Burnt Oak sub-station by means of two three-core cables from the Golder's Green sub-station, where control is effected by manually operated circuit breakers. When the operator closes an oil feeder circuit breaker at Golder's Green, the rotary to which it is connected at Burnt Oak starts up automatically, and takes up the load, and thereafter being under control of the automatic gear in the Burnt Oak station.

The only high-tension gear at the Burnt Oak station consists of change-over isolating switches, which are arranged so that for normal operation each rotary is connected to a separate feeder. The bus-bars to which the two incoming feeders are connected are housed in five brick and stone cubicles, of the London Electric Railway Company's standard type. The bus-bars are in two sections and change-over isolating switches between the bus-bars and the transformers enable either rotary to be operated from either feeder, whilst in the event of a breakdown on one of the feeders both machines can be operated from the second feeder.

The high-tension cell work occupies a central position at one end of the building, and immediately in front of it the main transformers are mounted. There are two three-phase banks of air blast transformers, each consisting of three 440-kilovolt-ampère, single-phase units, which are delta connected on the high-tension side, and double delta connected on the low-tension side. The cooling air for each bank is supplied by a centrifugal blower, which discharges through a duct formed in the trans former foundations. The squirrel cage motor which drives this fan also operates a small generator which is used to determine the polarity of the rotary at starting.

A low-tension alternating-current supply for the control circuits is provided by a small single-phase transformer, which, together with the blower motor, is connected to the low-tension side of the main transformers. In front of each bank of transformers there is an automatic starting panel—as shown in Fig. 4—and in addition to the starting and running contactors these panels carry three small contactors for controlling the fields of the rotary and the auxiliary generator. Each rotary—see Fig. 6—is rated at 1200 kilowatts, and runs at a speed of 500 revolutions per minute, the pressure on the direct-current side being 600/630 volts. Details of the precise method of starting will be given in the forthcoming article to which we have alluded.

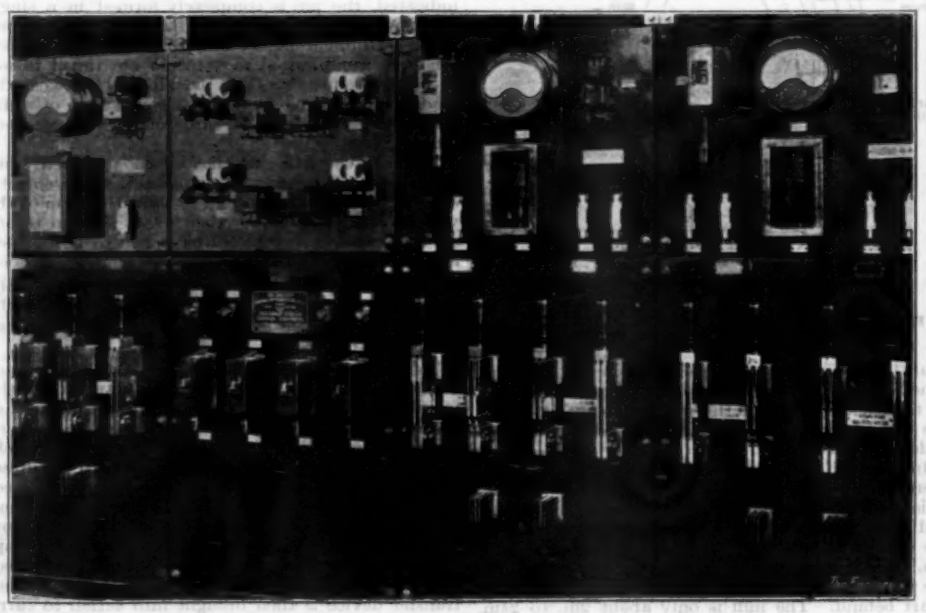


FIG. 7—TRACK FEEDER PANELS

The direct-current switchgear—shown in Figs. 5 and 7—consists of two machine panels and a feeder board, with accessories. In addition to instruments, each board is fitted with the relays required for controlling and for protecting the machine, and standard lever type isolating switches. A multiple change-over switch and three small control switches are also provided to enable each machine to be operated manually if necessary. The feeder board, which is shown in Fig. 7, controls four circuits, and in view of the fact that an insulated return rail is used, circuit breakers are provided on both poles.

When it is required to start up a converter at Burnt Oak, the attendant at Golder's Green closes the appropriate high-tension circuit breaker, thus giving a high-tension supply to Burnt Oak. The main transformers are thus energised, and they, in turn, energise the control transformer, the blower motor and the oil pump motor. When the auxiliary generator has built up its voltage, thus indicating that the blower is running at its normal speed, and the transformers are receiving their supply of cooling air, the rotary converter may take up its load.

Provided that the master controller—shown in Fig. 8—which is mounted behind the direct-current panel, is in the off position, a master contactor then closes, and if the master controller is not in the off position, it must first turn to that position, thus ensuring that a complete sequence of switching operations must be gone through at each start. In order to secure this result, the master control contactor is fitted with a contact which is normally

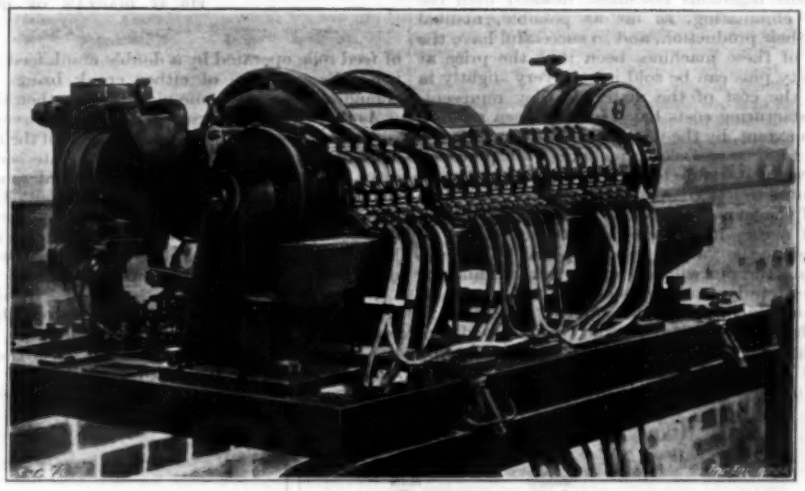


FIG. 8—MASTER CONTROLLER

closed, and which provides a circuit for the controller motor when the contactor is open. On reaching the "off" position, the controller stops automatically, and waits for the contactor to close. The closing of the master control contactor energises the control bus-bars and sets the motor-operated controller in motion. The first action performed by this item of the equipment is to close the starting contactor, thus connecting the starting motor to the transformer, when the rotary starts.

At the same time, the auxiliary field winding on the rotary is connected to the auxiliary generator, thus ensuring that the machine builds up its voltage with the correct polarity, and the main field winding is connected to a tapping on the field rheostat, so as to give the correct field strength for synchronising. At this point the controller stops and waits for the machine to synchronise, and when the rotary is in synchronism, the controller is restarted by a synchronous speed indicating relay, and closes the running contactor, thus short circuiting the starting motor and connecting the converter direct to the transformer. Continuing its travel, the controller then opens the starting contactor, changes over the field of the rotary from the rheostat tapping previously mentioned to the field rheostat arm, and disconnects the auxiliary field winding from the auxiliary generator.

Normally the field rheostat arm is left in the position which gives full volts on the rotary, but means are provided for raising or lowering the machine volts if occasion should arise. As at this stage the machine is not connected to the direct-current bus-bars, there is no possibility of the polarity of the auxiliary generator being reversed by short circuits or heavy overloads, which may react on the field winding of the rotary. Further movement of the controller closes the machine line contactor, and high-speed circuit breaker, and the rotary takes up its load. At this point the controller again stops and remains at rest as long as the rotary is in operation. The feeder

breakers close automatically as soon as the bus-bars are energised, but, as it may sometimes be desirable to feed through the sub-station to the Burnt Oak section of the track, without running up a rotary at Burnt Oak, the two feeder circuit breakers supplying the Burnt Oak–Golder's Green section are arranged to close either from track over-voltage or bus-bar voltage, whichever appears first. Once these two breakers are closed, the bus-bars of the Burnt Oak sub-station are, of course, made alive through them, and the remaining circuit breakers close automatically with the bus-bar voltage.

To shut down the machine, the high-tension feeder circuit breaker at Golder's Green is opened, and this de-energises the main transformer, with the result that the master control contactor opens and the machine shuts down, the master controller returning automatically to the position in readiness for the next start.

Protective devices are provided for the following contingencies:—Direct-current overloads and short circuits, overspeed, alternating current under voltage, single-phase starting, incomplete sequence, overheating of machine, overheating of transformers, loss of supply for direct-current control circuits, failure of blower motor, direct-current earth leakage, incorrect polarity, hot bearings, overheating of the starting motor and direct-current reverse power.

British Wire-drawing and Wire-working Machinery.

No. VI.—SAFETY-PIN MAKING.*

COMPETITION in the manufacture of the ordinary domestic safety pin has resulted in the evolution of several most ingenious machines, devised with the object of eliminating, as far as possible, manual labour in their production, and so successful have the inventors of these machines been that the price at which safety pins can be sold is only very slightly in excess of the cost of the materials they represent. The manufacturing costs have, in fact, been reduced to such an extent, by the use of automatic machinery, that the total wages cost, including all processes from the raw material to the finished article, ready for sale, amounts to less than 1d. per gross of pins. This fact is all the more remarkable when it is borne in mind that a very high degree of accuracy has to be maintained or the various processes will be put out of gear, and the pin will not act properly, while the demands of retailers are very exacting as to the finish and style in which the pins are offered.

Through the courtesy of Messrs. George Goodman, of Birmingham, we had an opportunity of following the whole process of making safety pins, from the reception of the raw materials to the dispatch of the packages, and the following notes, which are based on that exploration, aim at giving a rough outline of the machines and operations adopted, although it is impossible, in the space available, to describe them in detail.

It is noteworthy, in connection with this factory, that the owners claim to have succeeded in meeting German competition, notwithstanding the depreciated currency in that country and the high cost of raw materials in this.

There are, of course, several different types of safety pins, and the one we deal with first is that in which a separate sheet metal cap is used to protect the point. The pins are made by one or the other of two processes, one of which requires two machines only, while in the other the two operations performed by the second machine are separated and three machines are thus required. Small quantities of special pins are made largely by hand, but the appliances then used are comparatively simple, and not nearly so interesting as the automatic machines described below.

* No. V. appeared August 15th, 1924.

The first operation is to straighten, cut off and point the wires, and here a distinctly different process is adopted from that used by needle makers. It is essential that the wires should all be exact to length as otherwise the subsequent operations would be put out of gear, and it has been found that the necessary exactitude cannot be attained if the pins are pointed with the grinding wheel running away from the point. The grinding has to be done towards the point, and the arrangement of the machine used for the purpose is shown very roughly in the sketch, Fig. 42.

The wire is supplied in the form of ordinary coils, and is placed on a swift at the back of the machine. It is drawn forward through a rotary bord, or straightener, comprising a series of pegs in a rotating frame, through which the wire is pulled by a pair of feed rolls operated by a double-crank feed mechanism. Each stroke of either crank brings forward enough wire to make one pin, which is then cut off.

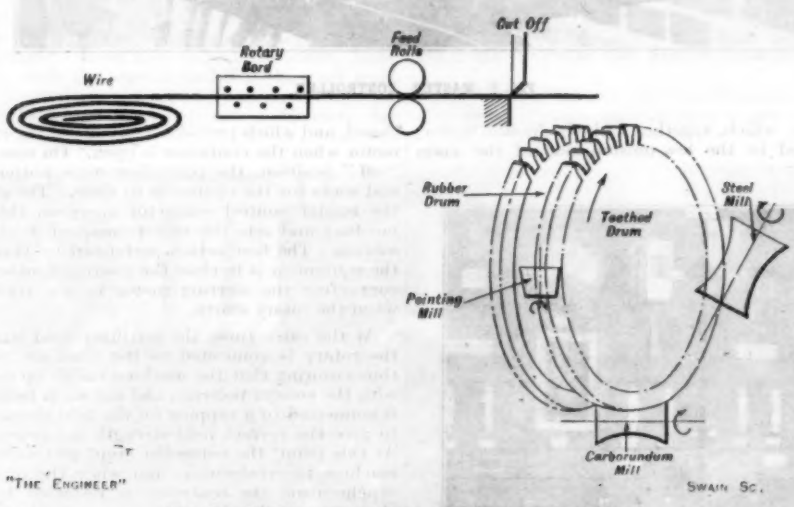


FIG. 42—DIAGRAM OF SAFETY PIN POINTING MACHINE

As the wire is fed forward, it protrudes over a drum turning on a horizontal axis in the front of the machine. This drum is built up of three separate sections or discs. The two outer discs are toothed round their edges—inserted teeth are used so that breakages may be more readily repaired—while the central disc is shod with rubber. The rubber drum is driven by internal gears at double the speed of the toothed discs, and in the same direction.

At the moment that the length of wire is cut off from the stock, a finger comes down from above and pushes the wire squarely into the notches between the teeth of the drum below. Then, as the wire is moved forward by the teeth, it is dragged under a saddle curved to the same shape as the periphery of the drum. The teeth hold the wire square, and at the same time the rubber drum rolls it over against the saddle. At the back of the drum there is a plate against which the wires butt, so that their protrusion in the front is determined exactly.

In front of, and alongside, the drum on the right, there is a fast-running steel mill with file-cut teeth. This mill is hollow-shaped, as indicated in the sketch, and is so positioned, with regard to the drum that the desired curved taper is given to the point of the pin. The mill, as already mentioned, rotates towards the point, and an exhauster is used to carry away the swarf behind. The mill is only about 2in. to 2¼in. in diameter, but runs at 5000 revolutions per minute, and removes the material more by a rubbing action than by cutting. Although, as already mentioned, it has file-cut teeth, these teeth are very quickly worn down, and the mill then acts like the disc saws used in steel works. There does come a time, however, when the mill becomes too highly polished, and has to be re-cut. The action of the fast-running mill naturally heats up the wire considerably, so much so, in fact, that it is raised to a red heat, but it has no detrimental effect on the metal for such services as those to which safety pins are put.

After the wire has passed the steel mill, it goes on to a corresponding carborundum wheel below, which puts a better finish on the surface. In the sketch, the carborundum mill is shown set at an angle to the drum, like the steel mill; but in some of the machines it is mounted in a frame parallel with the face of the drum, and is given a reciprocating motion, so guided as to follow the contour of the point.

Finally, the wire passes a third mill, which just touches the point at a fairly obtuse angle, and sets it in the same way as an edged tooth is set.

The reason for using a steel mill and then one of carborundum for pointing the pins, instead of attempting to take off all the material with a carborundum wheel, is that the action of working on the square point of the wire would quickly tear the stone to pieces. The steel mill will, however, stand the punishment, and the carborundum has only to put on the finishing touches, so that it lasts for months.

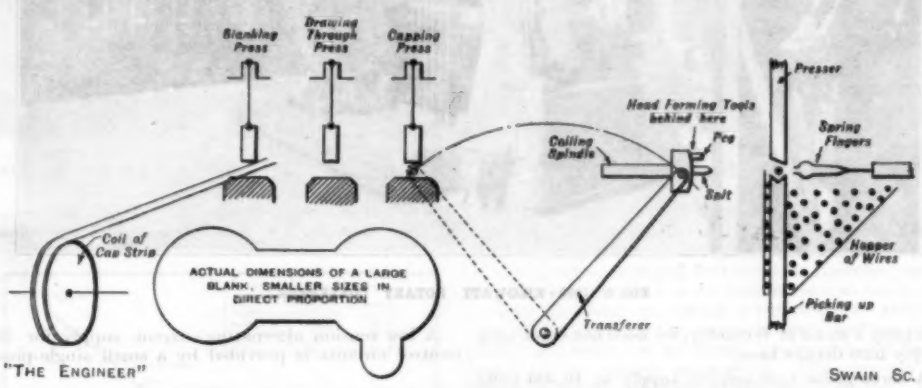


FIG. 43—DIAGRAM OF GOODMAN'S SAFETY PIN FORMING MACHINE

The bearings of these mills have naturally to work in adverse, gritty conditions, but they last without appreciable wear for years. The spindles are made of a special steel, case-hardened and ground, while the bearings are plain cast iron bushes. A peculiarity of the bearings is that their outside ends are capped. Grease is forced in at this end and gradually extrudes at the other, so that there is no chance of access for grit. The same effect could not be secured if both ends of the bearing were open and the grease supplied at the centre, as one side would be sure to be robbed of grease by the other, and the grit would get in on the dry side.

Although it does not appear at first sight that the amount of work necessary to point the pins would be very great, these machines take some 3 horse-power each, which is to be accounted for by the number of high-speed parts—the rotary bord, the three mills and the exhauster.

After the wires have passed the three mills they are wiped off the drum into a hopper, from which they are collected at intervals and taken away for the subsequent operations.

In one of the two main processes, as already indicated, the pin is completely formed in a single machine, the invention of Mr. B. L. Goodman, which is almost human-like in its operation, and in which the most complicated movements are timed to act in proper sequence. The machine is fed with the ready pointed wires and with a coiled strip of metal for making the caps. It turns out complete safety pins.

The sketch—Fig. 43—has been prepared with the object of helping to explain the movements, although it does not pretend to show the form of the various essential parts or their exact relation to one another, while many pieces have had to be omitted altogether in order to reveal the more important ones.

Three distinct functions are performed by the machine. One is the making of the cap, another the formation of the wire stem, and finally the assemblage of the two.

Taking the cap first, the strip is fed by a pair of rolls across a drum, which coats the lower side of the metal with a film of oil, and then between a pair of press tools. These tools cut out a blank more or less of figure-of-eight form—as shown in the sketch. A transfer device then carries the blank to the drawing-through press, where a blunt-ended punch forces the blank through a hole in the bed of the press and completely forms the cap in one operation. Below the bed are two fingers, waiting to receive the cap. They are rocked forward, immediately it is received, and push it out through a slot in the bolster. Another transfer device is then brought into action to carry the cap along and place it in the capping press, with its open end to the front, ready to receive the formed wire.

The drawing-through operation is the most troublesome of all the processes, owing to the liability for the tools to scratch the metal. In the case of steel caps, the scratches sometimes appear almost immo-

diately after fitting new tools, in which case the machine must be stopped and the tools polished again. The tools are made of crucible steel, and are left dead hard, automatic lubrication being employed.

The cause of the scratches is not primarily due to the wear of the dies, and it would appear that in cutting the blank, although the tools are kept as nearly perfect as possible, there is a very slight burr or roughness on the top edge of the blank. In the process of drawing the pressure is very great, and minute particles of metal get detached, probably from this burr or edge, and by some means or other become attached to the sides of the die.

This metal forms a slight pimple, which in the early stages can only be seen by a strong magnifying glass. The pimple, however, once formed, cuts into each succeeding cap as it passes, causing the scratches, and rapidly increases in size. The peculiarity of these pimples is that they become as hard as glass, and can only be removed by rubbing down by hand with ragstone.

The pointed wires are supplied from a hopper on the right of the machine and are picked out, one at a time, by a rising bar. The top edge of this narrow bar is cut with a fine V groove, and every time it makes an up stroke it picks up a wire. It is remarkable that the bar never fails to produce a wire, although no great harm would be done if it did fail. The wire is held in the V groove by a light presser above, until a pair of spring fingers, moving in a horizontal direction, come forward and grasp it.

These fingers carry the wire or stem over to the head-forming tools, shown in the sketch Fig. 44, which is an end view of part of Fig. 43, looked at from the right. The blunt end of the stem is gripped between the head-forming punch and its bed, while the middle of the wire rests on a fixed spit protruding from the end of a coiling spindle. The spindle is also provided with an excentrically placed peg, which bears against the other side of the wire and winds it round the spit as the spindle rotates. In the sketch the spindle has made about a third of a revolution since the wire was inserted. The spindle is then rotated one and a-half times to form the spring loop and at the same time the head-finishing tool comes into operation and completes the formation of the J-shaped end that is destined to be fixed in the cap.

The wire stem is now complete, ready for assembly with its cap, to which it is carried by a transferring device. In order to release the wire from the previous operation the coiling spindle reverses for a quarter of a revolution and thus frees the central spit from the grip of the wire. The spit is then withdrawn axially and then the coiling spindle recedes to allow the fingers of the transfer device to grip the pin. As soon as the fingers have got hold the head-forming tools release the other end of the wire.

The transferer is carried by an arm that oscillates on a horizontal shaft and also moves in the direction of that axis. It is provided with two spring-controlled fingers which grip the two legs of the bent wire stem and hold them in the normal position of a closed complete pin. To take its hold the transferer moves backward from the front of the machine towards the wire stem, and as soon as the peg of the coiling spindle has been retracted it comes forward again, bringing the pin with it. The arm is then rotated through an angle of about 90 deg., which brings it opposite the capping tools, as shown by the dotted lines in the sketch. Here the arm moves backward again and inserts the J-shaped end of the wire into the back of the cap in the press, while the point also is entered in its place. At the last part of this stroke the spring fingers are released, a tool comes down in the press and nips the cap tightly on to the J-shaped part of the wire. The completed pin is ejected and the process repeated.

The speed at which these machines work produces from sixty to seventy-five pins per minute and is practically only limited by the rate at which the drawing process works. To watch them in operation is most fascinating, as there seems to be no hurry about the work, neither is there any appreciable noise, just a gentle clicking. In fact, the pins dropping into the tray below make almost as much noise as the machine itself. Another remarkable fact is that the whole of the mechanism is contained within a framing about the size of an ordinary card table.

The completed pins are collected from the machines periodically and taken to another department, where they are scoured, cleaned, plated, and so forth; but as these processes are common to many trades they need not be enlarged upon here.

The machine described above can be used to produce safety pins of any suitable metal, but, generally speaking, it is used for making the cheaper qualities. For the best quality safety pins another method is used, as, in order to get a perfectly finished article, it is necessary to grind the caps before assembling. The group of machines used for this work comprises units for (1) straightening, cutting and pointing; (2) cap cutting and drawing; (3) cap scouring or grinding; (4) automatic coiling and capping (assembling).

The cap-forming machine needs no further description, as it closely follows that already described; but the hopper feed mechanism for the assembling machine is distinctly interesting and ingenious.

It is evident that the caps must be offered up to the machine in the correct position, or it will not be possible for the wire stem to be entered in place, and although there are many different attitudes which the cap might take up, it is so nearly symmetrical in shape that there is no ready means of guiding it into position. Added to this difficulty there is the peculiarity that the caps will not readily flow out of the bottom of a hopper. They must be taken away from the top of the heap.

The hopper is consequently provided with a constantly running chain, which acts like a ladder dredger, while the store of caps is agitated by two rocking arms. The chain is fitted with tongues on the links, which are so shaped that they will only engage with the opening in the side of a cap in such a manner that the cap is carried forward in the desired attitude. Caps which present themselves to the chain in any other position are ignored and left behind. The correctly placed caps are carried up by the chain and delivered to a shoot, down which they slide into the closing press.

It will be readily appreciated that the teeth on the dredger chain may not always pick up a cap, and there is thus a liability for the feed to be intermittent; but the rest of the machine goes on regularly, which might result in a wire stem being presented to the closing press when there was no cap there and that stem would be wasted.

To overcome this difficulty the shoot already referred to acts as a stock tube, in which a certain number of caps accumulate. The speeds of the dredger chain and the rest of the machine are so adjusted that, taken over a period of, say, a minute, more caps are picked up out of the hopper than are required by the machine. Towards the upper end the bottom of the shoot is formed as a trap door, and the distance from this door to the bottom of the shoot is such that it will contain enough caps, according to the law of averages, to make up for the worst likely failure of the chain in picking up caps. In order to guard against over-delivery by the chain, which would choke the mechanism, the trap door is periodically opened automatically. Then any caps in excess of

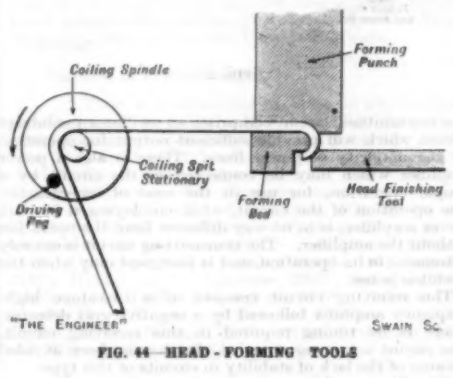


FIG. 44—HEAD-FORMING TOOLS

the necessary stock, which may have come over, will be deflected and will fall into a special hopper, to be returned to the main hopper by hand.

The closing press, wire coiling mechanism and transferer of this machine are similar to those already described and need no further comment.

There are, of course, several other types of safety pins besides that having a sheet metal cap. One familiar form is made entirely of a single piece of wire, with a coiled loop at either end, and is made by a machine employing some of the principles already described.

In this case the pointed wire is taken from the hopper as before, and one end is inserted in a press which has a V notch in the anvil with a corresponding tool above. When the press descends it squeezes out the end of the wire into a more or less spoon shape, the recess of which ultimately acts as a sheath for the sharp end of the pin when in use.

While the wire is held by the press a coiling spindle advances and makes the spring loop as in the other type of pin. The bent wire, of which the two legs are unequal in length to the extent necessary to provide for the second coil, is then transferred to another spindle for making the loop at the sheath end of the pin. This spindle, however, is of a different type, as it has to make the coil without fouling the point of the wire.

The working end of the spindle looks somewhat like a spiral sea shell with the base cut open. Into the recess thus formed the spoon end of the wire is thrust by the transferrer and the spindle immediately begins to rotate. This action naturally coils up the end of the wire—to the extent of one and a-half turns—but the point is not also caught up in the recess, as, by the time it is drawn in towards the spindle, the sloping face of the spiral is presented to it. Consequently the point merely slides up this slope until the edge of the recess comes round, when it springs down into place in the spoon and the complete pin is ejected.

A large variety of other pins is made in the factory under review, such as the big ones used by the natives in South Africa for fastening their blanket robes and those, more closely resembling brooches, which are fancied by some young men for fixing their neckties, both of which are made by entirely distinct processes; but sufficient has been said to indicate the nature of the machinery employed.

There is one other most ingenious machine used in this factory, which takes the pins as they come, closed, from the shops and sticks them through cards for retail trade, but as it is still being elaborated, while patent rights have not yet been secured, we are not at liberty to describe it at this stage.

We are asked, by William Grice and Sons, Limited, of Fazeley-street, Birmingham, to point out that they, also, are manufacturers of the type of pointing machine, illustrated by Fig. 10, on page 110 of our issue of July 25th. In the case of this machine the throw is adjustable, so that the movement of the rolls can be readily controlled.

Life-saving Appliances for Merchant Shipping.

In a publication recently issued by the Board of Trade and obtainable at any of his Majesty's Stationery Offices, particulars are given of the new rules relating to the life-saving appliances to be carried aboard ship. The Merchant Shipping Act of 1894 provides that these rules shall not come into force before they have lain for forty days before both Houses of Parliament during the Session of Parliament. The enacting clause provides that the new rules shall come into operation on the first day of January, 1925.

According to the already existing rules, it is required that lifeboats sufficient to accommodate all persons on board shall be carried on all foreign-going passenger steamers. The new rules give particular prominence to the principle that all the boats must be readily available in the case of an emergency. Where an ocean-going ship launched before January 1st, 1925, is constructed in such a way that it is not possible to carry the number of boats required in such a position that they are ready for immediate launching, it is allowed to make up the deficiency by means of approved buoyant apparatus. All foreign-going passenger ships must also carry, in addition to their ordinary equipment, buoyant apparatus sufficient for 25 per cent. of the total boat capacity required to accommodate all the persons carried.

It is provided that where the number of lifeboats is more than ten, one of them shall be fitted with an approved wireless telegraphy installation. Further, where 15 lifeboats are carried one shall be a motor boat fitted with wireless, and two such motor boats shall be carried on all ships with more than 20 lifeboats. It is required that all motor boats are to be fitted with a searchlight.

In the section of the rules dealing with launching gear it is stated that the boat-lowering gear shall be of sufficient strength to lower the boats safely with their full complement of passengers and crew and full equipment; further, that the davits shall be fitted with turning-out gear of sufficient power to insure that the boats can be turned out against the maximum list under which the lowering of boats is possible. Following the recent recommendation of the Court inquiry into the loss of the Trevessa and the experience of the boat crews of that vessel, it is now provided that in addition to water and biscuits, one pound of condensed milk must be provided for each person the boat is certified to carry. An efficient compass, oil for stilling heavy seas, matches and self-igniting red lights must also be carried. Under the new rules all ships must carry a certain number of rope ladders, which are to be of sufficient length to reach the water line at the vessel's lightest sea-going draught. Such ladders are to be available for embarking passengers in the boats or rafts.

On all foreign-going passenger steamships in which the boat deck is more than 30ft. above the water provision must be made for illuminating the lifeboats from the ship during the launching of the boats. An amendment has been made to the rules for motor boats making short excursions to sea. The new rules require that such vessels shall carry buoyant apparatus for a certain percentage of the persons carried, and lifebuoys in accordance with the size of the vessel. Accompanying the new rules are appendices giving tables of boat and davit particulars for the various sizes and classes of vessel.

Australian Engineering Notes.

The Sydney City Council is spending £375,000 in converting the overhead high-tension conductors to underground. The portion of overhead conductors to be first dealt with will be that lying within the municipalities of Alexandria, Vaucluse, Waterloo, Waverley, and Woollahra, at an estimated cost of £34,000.

* * * * * *

After negotiations lasting about a year, the draft of an agreement for the construction of the Kyogle-Brisbane Railway has been sent by the Federal Minister for Railways to the New South Wales and Queensland Governments for their concurrence.

* * * * * *

The Walsh Island Dockyard has received a contract for the building of three cargo vessels of 400 tons deadweight each, to the order of Dorman, Long and Co., Limited, the contractors of the Sydney Harbour Bridge. The vessels are to be used to carry stone to the bridge.

* * * * * *

A tender by the Sydney representatives of Armstrong, Whitworth Pty., Limited, amounting to £22,137, has been accepted for the cutting of the Ralph's Bay (Tasmania) neck canal. This waterway, by connecting the river Derwent with the east coast of Tasmania, will obviate the necessity for vessels bound for the east coast from Hobart to pass through Storm Bay.

Carrier Telephony on Power Lines.

A PAPER by Messrs. N. H. Slaughter and W. V. Wolfe, in the *Journal* of the American Institute of Electrical Engineers, deals with carrier telephony on power lines. In selecting the frequency band best suited for carrier telephony on power circuits, the characteristics of both the line alone and the transformers indicate that the use of frequencies in the band between 50 and 150 kilo-cycles will result in satisfactory operation. From the standpoint of interference, this frequency band is also desirable. The frequencies are too high to interfere with commercial telephone systems since the present limiting frequency for multiplex systems is about 35,000 cycles; and they are too low to interfere with broadcasting or marine radio communication. They are, however, in the band of frequencies employed for certain classes of radio telegraph service. From the standpoint of coupling the carrier equipment to the power line, this frequency band is desirable, since coupling by means of capacity becomes easier as the frequency is increased. In the development of this carrier equipment, it was early decided to employ a full metallic high-frequency circuit.

The provision of proper means for connecting a carrier telephone circuit to the high-voltage transmission lines is one of the most difficult problems involved. The coupling device must offer a safe and efficient means for transferring high-frequency energy to and from the power lines. The capacity coupling seemed to offer the most feasible solution of the problem. The first type of

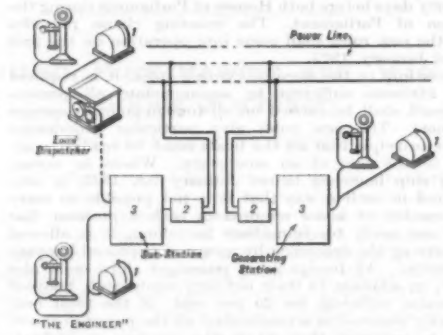


FIG. 1

condenser considered was a condenser composed of a single wire parallel to the power-line conductor and the conductor itself. This type of condenser has two fundamental weaknesses. In the first place, it has what is known as distributed capacity, and in the second place, its capacity to earth is generally larger than the capacity to the power conductor. The use of this form of condenser lends itself best to a tuned circuit, similar to that employed for radio-transmitting circuits. The major part of the energy, which in a radio-transmitting circuit would be radiated into the ether, is transferred from the antenna to the power-line conductor by virtue of the capacity existing between them. There are two serious objections to this type of circuit. Since it is a tuned circuit the frequency band which can be transmitted is very narrow, which renders this arrangement less suitable for duplex operation than the filter arrangement described below. The second objection is that a portion of the energy delivered to the antenna is radiated and may be picked up by a suitable receiving set; and might involve the licensing of carrier equipment and the employment of licensed operators. From the standpoint of reception this type of coupling is also undesirable. The use of concentrated capacity avoids all the difficulties, but it introduces the problem of insulating the condenser plates. The development of a satisfactory condenser has, however, been undertaken by one of the American power line manufacturers.

The coupling capacity may be employed either as a part of a series resonant circuit, or as a part of a filter circuit. The former lends itself to the transmission or reception of a narrow frequency band, but it is not efficient for the simultaneous transmission and reception of signals of two different frequencies. Filter circuits can, however, be designed to pass a relatively wide band of frequencies with a small attenuation. The filter also simplifies the problem of static 60-cycle charges since it provides a path to earth for low-frequencies without earthing the high-frequency circuit.

The power required for telephone transmission over power lines is largely determined by the magnitude of the disturbing currents or noise which have frequencies in the range of the carrier equipment. If no noise were present the carrier transmitter would not be called upon to increase the power delivered by the telephone transmitter, but would merely have to change the frequency band. The receiving equipment would then furnish all the amplification needed to counterbalance losses in transmission over the system. However, in practice noise exists in the form of more or less infinitesimal electrical disturbances at all frequencies, and the level of the noise generally decreases as the frequency increases. Based on a knowledge of noise conditions on transmission lines and with other practical considerations in mind, the receiving gain has been limited to a voltage amplification of about 100, which corresponds to a power amplification of about 10,000. Since it is desirable to deliver about .01 watt to the telephone receiving circuit, a carrier-frequency power as low as .000001 watt at the input to the receiving circuit will produce satisfactory results under favourable conditions.

To allow for less favourable conditions it is assumed that a power of .00001 watt is required. An output of 1 watt from the transmitting circuit is sufficient for operation over 265 miles when the carrier frequency is 150 kilo-cycles and with no loss in the coupling device or the associated power equipment. Actually the loss arising from other transmission lines connected to the line on which the carrier is operated, the loss in power equipment and that in the coupling device may reduce this normal range to 100 miles or less. It seems probable, therefore, that a relatively small output from the transmitting circuit will be sufficient for normal operations on the majority of transmission lines. As, however, telephone service is often of the utmost importance, a transmitting output should be available that is sufficient to ensure satisfactory operation under unusual line conditions and actual failures.

In order that duplex operation may be secured it is necessary to operate the transmitting and receiving circuit simultaneously, which means that the receiving circuit designed to operate on an input of .00001 watt must operate in parallel with the transmitting circuit, which may deliver as much as 50 watts to the power line. This large power ratio makes the separation of the transmitted and received currents a difficult problem, which, however has been solved by the use of electrical filters. By employing frequencies for transmitting and receiving which differ by about 20,000 cycles, it is possible to permit the transmitting circuit from interfering with the receiving circuit. For this purpose "high-pass" and "low-pass" filters are employed. The former passes frequencies above 100,000 cycles and attenuates frequencies below that value, whilst the low-pass filter passes frequencies below 80,000 cycles and attenuates frequencies above 80,000 cycles.

The diagram—Fig. 1—is a block schematic diagram of a carrier telephone system, developed for use on high-voltage power lines. The ringing keys are shown at 1, the coupling devices at 2, and the carrier equipment at 3.

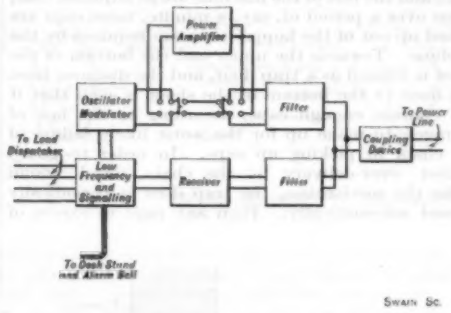


FIG. 2

The transmitting circuit comprises an oscillator-modulator circuit which will provide sufficient output for operation on the majority of power lines. There is also a power amplifier which may be connected in the circuit by a simple operation, for use in the case of emergencies. The operation of the circuit, while employing a 50-watt power amplifier, is in no way different from the operation without the amplifier. The transmitting circuit is entirely automatic in its operation, and is energised only when the circuit is in use.

The receiving circuit consists of a two-stage high-frequency amplifier followed by a negative grid detector. There is no tuning required in this receiving circuit. The circuit is not regenerative, that having been avoided because of the lack of stability in circuits of this type.

Signalling on this carrier circuit is entirely automatic, and where more than two stations are involved, it is selective. The operation of the ringing key sends out a predetermined train of pulses at the carrier frequency. These pulses, when received and rectified, operate a selector of a type commonly used for telephone dispatching on American railway lines.

The voice-frequency telephone circuits are standard circuits suitable for either two-wire or four-wire operation. The circuit may be extended to a telephone situated

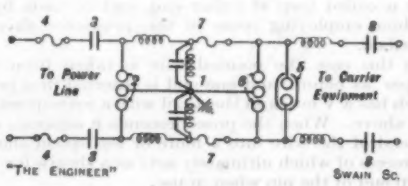


FIG. 3

at a point several miles from the carrier equipment with full control of the carrier, as is desirable in the case of the load dispatcher, or without control of the carrier; that is to say, where the load dispatcher is placed at a point some distance from the carrier terminal, he may be provided with the same control and talking facilities as for the terminal power. It has been decided that the separate-control circuit results in the most simple and reliable arrangement. Accordingly four wires, two for talking and two for control are required. (See Fig. 2.) Where it is not desirable to provide control of the carrier equipment, the talking circuit may be extended through a standard board in a manner similar to that employed for ordinary wire-telephone circuits. Two or more carrier systems of this type may be operated in tandem where circumstances make this scheme possible and desirable.

The power supply for the carrier equipment may be obtained from any source which is convenient. The valve filaments require 24 volts and a direct current of only a few ampères, which can be supplied from storage batteries. The plate circuits of the receiver and the low-power transmitter require 150 volts, and a direct current of a fraction of an ampère. This can be obtained from storage batteries, or a motor generator driven from the 24-volt supply required for the filaments. The high-power transmitter requires 800 volts—direct-current—for the plate potential, and this can be obtained best from a 150-watt motor-generator set driven from the 24-volt source. This provides a power supply independent of the transmission line, an important point where transmission line failures or interruptions of power supply from other causes are likely to occur. Where the latter consideration is not important, both the 150 volts and 800 volts supplies may be obtained from rectifiers.

The valves employed in this equipment are of standard type as used in line telephone and radio practice. The average life of the valves employed in the receiving circuit is about 10,000 hours, which is equivalent to continuous operation for a little more than a year.

The protection of the *personnel* operating the carrier equipment, and the carrier equipment itself, from the high voltages employed on the power line is naturally of vital importance.

The diagram—Fig. 3—shows the method of coupling the power equipment to the power line. 1 is a resistance coil with the mid point earthed, 2 heavy duty static spark gaps, 3 condensers capable of withstanding power line voltage, 4 fuses capable of breaking a power arc at the line voltage, 5 vacuum spark gaps, 6 static spark gaps, 7 fuses, and 8 mica condensers, capable of withstanding a potential of 10,000 volts. The condensers 3 may be of the fixed condenser type or may be formed by the distributed capacity secured by suspending a wire parallel to the power line conductors. These condensers are designed and tested so that they have the accepted factor of safety required for work of this character. In event of a failure of these condensers, a momentary short-circuit current flows through the fuse 4 to earth at the point 1. The reactance shown, connecting this condenser to earth, is negligible at power frequencies since its inductance is a fraction of 1 millihenry. In spite of the low inductance of this coil, it is possible that an appreciable voltage may be developed across it and, therefore, heavy-duty static spark gaps, having about ¼in. clearance, are connected across this coil. On the carrier-apparatus side of this coil the fuses, vacuum gap and air gap commonly used for protection of wire

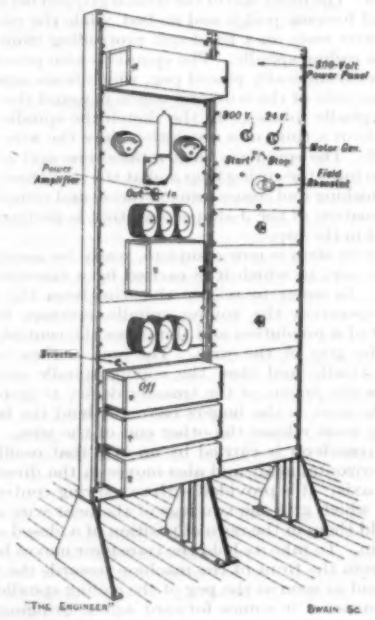


FIG. 4

telephone circuits paralleling high-voltage power circuits, are used, and as a final measure of protection, a high-voltage mica condenser 8 separates the coupling device from the carrier equipment. This circuit has been designed to secure the maximum possible protection both from static power potentials and from conditions which may arise because of the failure of the coupling condensers. The fuses shown at 4 are designed to break the power arc at the line potential.

This carrier equipment is suitable for power networks involving one or more transmission lines, extending for 100 miles or more from the load dispatcher's position. The exact length or extent of a transmission system over which this equipment will operate satisfactorily is, of course, difficult to predict, and each installation must be considered separately.

Ten or more carrier stations might be operated on a single line. The system would then compare with a commercial party-line telephone system, except that every station may call every other station without passing the call through a common point. In some cases, it may be desirable to pass the call through a common point. The change from one standard ringing key to another standard key accomplishes this result.

For power cables, the use of carrier telephony at frequencies of 100,000 cycles is not practical except in very short lengths of cable. However, lower frequencies may be employed for transmission on cables, although the coupling to the power conductor will be considerably complicated for lines of very high voltages.

The drawing—Fig. 4—shows a switchboard as installed at a terminal station.

UNIVERSITY COLLEGE ENTRANCE SCHOLARSHIP.—A Goldsmid Engineering Entrance Scholarship of the value of £40 a year, tenable for three years, is offered for competition at University College, London, in September, and is available for students taking the full degree course in engineering beginning in October. Full particulars of the scholarship examination can be obtained from the secretary of University College, who will also supply information relating to degree and diploma courses in engineering which begin in October. The engineering laboratories at University College have recently been extended and their equipment n creased at a cost of about £54,000.

Provincial Letters.

THE MIDLANDS AND STAFFORDSHIRE.

(From our own Correspondent.)

Increased Activity.

THERE was increased activity, I am glad to say, at the weekly meeting of the Midland iron and steel trade at Birmingham to-day—Thursday. True, it was confined chiefly to raw iron, but, nevertheless, it caused both producers and consumers of materials of all classes to shake off to some extent their lethargic mood and take a little interest in the course of the market. Both consumers and merchants came on to the market prepared to do business in pig iron, and some fairly large deals resulted. Not only were foundry brands bought, but forge material, which has been neglected for many weeks past, was again the subject of inquiry, and some contracts were entered into for this class of material also. There was no increase in the demand for finished materials. Manufacturers have large accumulations of continental semis to work off, and the local mills are in most cases short of orders. Prices were not materially altered, though in one or two cases pig iron makers endeavoured to secure something above the recent very low prices. It is hoped that business will now mend, and that the autumn demand will make itself evident early. The prospects are encouraging in some directions. Very much will, however, depend upon the peaceful solution of the labour problems, which are now in suspense. Producers are eager to improve the present unprofitable prices, but until demand flows steadily again they realise it would be unwise to make price alterations.

Pig Iron Activity.

It would appear that some Staffordshire iron masters and merchants have come to the conclusion that the time is opportune for renewing favourably their pig iron supplies, for on 'Change in Birmingham to-day—Thursday—some very fair lots of both foundry and forge iron were the subject of negotiation. For weeks past the forge iron department has been stagnant, while foundry brands have only been called for in very small lots, and to secure sales prices have had to be "cut." The gradual subsidence which has been in progress for months past has taken prices to an unremunerative level, and the question is now being asked whether the bottom has at last been touched. It is worthy of note in this connection that in the case of one Derbyshire foundry make, which could be bought at £4 5s. at furnace a week ago, the price has hardened to £4 6s. The quotations on 'Change to-day were: —North Staffordshire forge, £4; No. 3 foundry, £4 7s. 6d.; Northamptonshire forge, £3 17s.; foundry, £4 2s. 6d. upwards; Derbyshire forge £4; foundry, £4 5s. to £4 7s. 6d. per ton at furnaces. The position is being carefully watched. Stocks in consumers' hands have fallen very low, and the number of furnaces in blast is much smaller than when the autumn trade was approaching twelve months ago. Statistics of production during July show an output of pig iron totalling 611,800 tons, an increase of 4000 tons on June. The figures compare favourably with those of August last year, and as buying has been suspended for some time, optimists predict that consumers will soon be compelled to enter the market. The discouraging part of the records is the blowing out of eleven furnaces during the month, leaving only 174 at work, the lowest number in blast since December, 1922.

Finished Iron.

There is no improvement in the Staffordshire finished iron trade, and many of the mills are idle, while others are working intermittently on the re-rolling of continental steel. Prices of bar iron remain unchanged, marked bars at £15, Crown bars £13, and nut and bolt bars £12 per ton. Continental quotations for the latter material have advanced during the week. No. 3 Belgian iron is now about £8 5s. delivered. But as the nut and bolt trade continues quiet, very little iron of this class is called for, and Black Country sidings are still congested with foreign material of this type sufficient to last for some time. It is hoped that the engineering and wagon-building orders lately given out will eventually bring some business to the Staffordshire mills.

Galvanised Sheets.

Though new orders for galvanised sheets are coming in only intermittently, this continues the most active department of the market. Where mills are not fully booked there is a tendency to shade the quotation of £18 5s. for 24 gauge corrugateds. Demand for tin-plates has fallen very flat in this district. The rise in tin has sent up the quotation to 23s., or 4½d. above the basis. Mills do not appear to be under very heavy pressure, though there are substantial orders to work off.

Steel.

Though, as recorded last week, there is a slight improvement in the demand for steel, the continued lack of confidence is responsible for keeping many consumers from re-entering the market. It is known that additional important railway requirements are pending, and will be placed when prices are reasonably stable. The amount of business in structural undertakings is rather better than it was a year ago. Locally, there is much satisfaction over the recommencement of work at the steel-making establishment of Alfred Hickmans, Limited, Spring Vale, Bilston. The labour dispute is still unsettled, but the prospect of friendly co-operation with the Wages Board, in securing an amicable conclusion, is somewhat brighter. The appreciation of the franc is causing French and Belgian exporters to stiffen their quotations. In some cases the advances notified are considerable, but shippers do not adhere very firmly to them if they seem to stand in the way of business. Joists lately offered at £6 f.o.b. Antwerp are now 10s. dearer, and billets are increased in price about 5s., the present quotation being £6 15s., delivered, against the British price of £7 15s. The Belgians are cultivating orders for finished rather than for semi-finished steel, and are still able to undersell British material to a considerable extent. Consumers, however, show no disposition to enter into additional commitments. Native prices are substantially unaltered, though some producers of finished material are stated to be shading prices. Rollers of bars are in some cases endeavouring to get better prices, and have reverted to the old quotation of £10. Bridge and tank plates continue to be named at £10 10s., and boiler plates at £14 delivered, while Staffordshire hoops remain unaltered at £12. Billets vary between £7 12s. 6d. and £7 15s. Steel scrap is a weak market, sales having been made in this district at as low as £3 12s. 6d.

Production and Exports.

In Midland industrial circles the export tonnage of iron and steel, as revealed by the Board of Trade returns, is considered to be somewhat better than had been expected. The total exports during July were 347,799 tons, including scrap, against 314,522 tons for the corresponding month of last year, and 334,755 tons in June. Statistics of production have also created a favourable impression, the output of steel ingots in July being 693,300 tons, against 639,500 tons in the same month last year, an increase of no less than 53,800 tons. Further substantial increases have taken place in galvanised sheets, although there is a slight falling off in tin-plates. The serious part played by foreign steel is shown by the importation during July of 66,791 tons of billets, against 34,947 tons a year ago.

Rolling Stock Orders.

Midland engineers have received a fair proportion of the contracts for locomotives and railway rolling stock equipment recently given out, and local iron and steel makers will eventually be called upon to supply large tonnages of material for the carrying out of the orders. These include 58 third-class motor coaches (Metropolitan Carriage, Wagon and Finance Company, Limited, Birmingham) and 28 first and third-class composite trailer coaches (Birmingham Railway Carriage and Wagon Company, Limited), all for the Southern Railway. Seven 2-6-4 type tank locomotives (Kerr, Stuart and Co., Limited, Stoke-on-Trent), and 100 covered goods wagons and 100 open wagons for broad-gauge lines (Metropolitan Carriage, Wagon and Finance Company, Limited), for the Madras and Southern Mahratta Railway; 100 four-wheeled covered wagons and 100 four-wheeled low-sided goods wagons (Metropolitan Carriage, Wagon and Finance Company, Limited), for the Uganda Railways.

Increase in Unemployment.

There is a substantial increase in the number of persons unemployed in the Midlands. For the past few weeks the figures have gradually been going up, until, at date, they total 146,321. Returns issued by the various employment exchanges show that for the week ended August 11th, the number of persons out of work increased by no less than 7184. Of this total, 106,985 are men, 3788 boys, 31,522 women and 4026 girls. There are now unemployed in the Birmingham area 33,898; Bilston, 3849; Coventry, 3452; Cradley Heath, 4852; Dudley, 4225; Hanley, 4250; Leicester, 2940; Longton, 4665; Northampton, 1433; Nottingham, 9020; Oldbury, 1891; Smethwick, 4393; Stourbridge and Brierley Hill, 4278; Tipton, 2355; Walsall, 5387; West Bromwich, 3198; and Wolverhampton, 6284.

LANCASHIRE.

(From our own Correspondents.)

MANCHESTER.

General Outlook.

IN the Manchester market and in Lancashire as a whole, the iron, steel and metal markets remain very dull and quiet. It seems to be believed that the downward movement in iron and steel prices must be nearing its end, and that any upward movement in the non-ferrous metals would be premature in the present state of world trade. If a successful termination of the London Conference is reached, there may be some slow recovery in the buying power of Germany, which may favourably affect the non-ferrous metal markets; but, on the other hand, there will be keener competition for European and export business in iron and steel. Hence it is very difficult to say whether or not a German settlement would prove any immediate assistance to our trade. In engineering certainly, we might expect keener competition; for it is abundantly clear that the Continent can work on much lower costs than are possible in Great Britain.

Metals.

The market for copper has again shown that "wobbling" tendency which on previous occasions during the last three years has always preceded a relapse, after an attempt at an upward movement. This has now happened so frequently that, when the market rises, it is very difficult to persuade consumers that the movement is anything but temporary; and hence a rise in the price of copper no longer acts, as it should do, as a stimulant to buying. It is, of course, impossible to say when the real upward movement will begin, but the general state of the consuming industries throughout the world makes us doubtful whether the time is yet propitious. The price of electrolytic copper in Manchester went up to £70 per ton, and that of best select to £69, but it is scarcely as strong as we write. So far as can be ascertained, the recent buying of copper in America was mainly speculative, and not industrial, and this, of course, means that the copper so bought has to be sold again. There have been no official reports as to the American copper production and sales, but the unofficial reports seem to show that no progress was made towards reduction during the last month or so; and, of course, what is wanted to put the market again into a position of strength is reduced production. The speculative movement in America seems to be based on the expectation of a genuine settlement of the German trouble, and the consequent evacuation of the Rhur by the Allies; and if this expectation should be disappointed, we might see a reaction in the speculative market. Prices, of course, cannot be forced down very far in any case, but a period of dulness and weakness would again occur. The position in the market for scrap metals, and particularly for old gun-metal and yellow brass, does not indicate that any special advance in copper is expected. The dealers here offer only low prices for these alloys, and it is said that the outlet for them is very much restricted. In the end, it will probably pay to accumulate stocks of gun-metal at £47 or £46 per ton, but some dealers seem now to have as much as they can hold, while waiting for a revival in the demand. In the market for tin rather violent fluctuations are still occurring, and no one can predict what may happen. There are optimists who still maintain that tin will again reach £300 per ton, but this view seems to be very sanguine. There is in the opposite camp a belief that tin statistics at the end of the month will show increased "visible supplies." Lead and spelter are both rather quiet markets, but the expected fall in lead prices has not yet come about. Spelter has been a little dearer, but it is still relatively very cheap.

Pig Iron.

There is very little change of a definite nature to report in the foundry iron trade of Lancashire. One cannot deny that there is a sagging tendency, mainly resulting from the fact that rather more iron is being made at the Midland furnaces than can easily be disposed of. The long period of unprofitable working has no doubt left some makers in a weaker financial position, and this accounts for forced sales at prices below the recognised market value. Such sales, of course, get known in the end, however secret they may be at first, and tend to demoralise the market. Nominally, the price in Manchester for No. 3 Midland iron is still 95s. per ton delivered; but actually, sales have been made, both of Lincolnshire and of Derbyshire iron, which work out at 93s. 6d. delivered. Most consumers here are now waiting for the price to get down to 90s., but, of course, there is no certainty that this will occur. The cost of Cleveland No. 3 in Manchester is still over 95s. per ton delivered, and before it could bring down the price of the Midland irons to 90s., it would have to fall another 3s. or 4s. per ton. The price of Scotch foundry iron here is rather easy at 108s. 6d. per ton delivered. Apparently, the make of iron is still too large in Scotland, although there are now only twelve furnaces on foundry pig. More damping down of these furnaces seems to be contemplated.

Steel.

The markets here for manufactured material of all kinds remain quiet and dull. For sheets there is still a fair demand, but for heavy material the call is only small and intermittent. Sellers of joists and angles quote £9 7s. 6d., but it is understood that £9 5s. delivered here would be accepted. Common steel plates are quoted here at £10 per ton, and it is said that makers are certainly losing the whole carriage on them, if not more. Flat bar steel seems now to be easy at £10 delivered. For iron bars at £13 to £13 10s. per ton there is very little demand; and unfortunately the less work there is at the forges the greater is the cost of producing the bar iron. Cheap foreign bar iron does not come much into Lancashire, but it prevents some of the sale of Lancashire bars in the Black Country.

Scrap.

The markets for all kinds of ferrous scrap are very quiet and dull. The value of steel melting scrap at a Lancashire station has now fallen to 65s. per ton, and this is a fairly moderate pre-war price. The only market for it is Sheffield, as for South Wales it would not be worth more than 60s. per ton on trucks here. For heavy wrought scrap the nominal price is 90s. delivered at the ironworks; but the demand for finished iron is so poor that the works are not inclined to pay the price for the scrap. Iron-founders are doing very little, and are not buying much cast scrap now. The nominal prices still range from 85s. to 87s. 6d. per ton; the latter being for the best lots of textile machinery scrap.

BARROW-IN-FURNESS.

A Dull Market.

There is not a single glint of brightness to relieve the dulness at present existing in the hematite pig iron market. There is a quiet trade of no bulk, which consists of parcels for various customers in the Midlands, Scotland and North Wales. None of these parcels assume heavy proportions, and the worst of it is that the outlook does not promise any change as far as one can see. In common with other iron districts, very poor trade continues to exist, and no one can say when there will be an improvement. There are the pessimists who aver that trade will be worse before it is better, and the number of such forecasters is not small. The fact that the steel departments are engaged off and on, means that a good proportion of the iron smelted finds its way eventually into the rolling mills, and unless there is an improvement in the steel trade, further stoppages will mean that makers will damp down rather than create stocks at works. Many customers are asking when the price of iron is coming down, for they are not experiencing much margin with present competition. The fall in the price of fuel last week will certainly benefit the smelter to some extent, but whether he will be able to hand on a little of that reduction to the buyer of pig iron is questionable at the moment. Iron at the present price leaves but little, if any, margin, but there may be some makers who, anxious to attract orders, may argue for a reduction.

Iron Ore.

The business being done in iron ore is only small, and really the remarks regarding the state of the iron trade cover the ore trade as well. Not much is going out of the district, and therefore the activity of the ore trade is governed by the state of the local iron trade, which, as

has been remarked before, is dull. Foreign ore is being imported carefully, so that there shall not be big accumulations at the works or docks.

Steel.

The steel trade is about the same. A few orders are held, but not sufficient by a long way to allow of regular working. It is a case of from hand to mouth. There are not many orders obtainable, and the prices which are securing them allow of no profit to local makers. Competition is not only very keen in this country, but the foreign makers are cutting in, leaving mills in this country far behind as regards price.

Shipbuilding and Engineering.

There was a launch from Vickers' yard on Tuesday, when the specially constructed steamer Gefaldine Mary, for the Anglo-Newfoundland Development Company, successfully entered the water. This steamer, the agents for which will be the Donaldson Line, is designed to deal with the ice in the St. Lawrence in the winter, and is to be largely engaged in the carrying of newsprint paper from Newfoundland to this country. The 10,000-ton cruiser Cumberland will probably occupy the berth just vacated by the Geraldine Mary.

SHEFFIELD.

(From our own Correspondent.)

Strike in the Heavy Steel Trade.

Just at a time when the heavy crude steel trade was struggling along under great difficulties, with production much reduced and orders scarce, there has come a strike which has to a large extent stopped activities altogether. A dispute relating primarily to the wages of semi-skilled men has affected three of the largest firms in the district, namely, Steel, Peech and Tozer, Limited, Rotherham; the Parkgate Iron and Steel Company, Limited, near Rotherham; and Samuel Fox and Co., Limited, Stocksbridge. About 7000 men are on strike. The melting plants shut down are capable of producing when fully employed about 25,000 tons of steel per week, but latterly they have not been at work to the extent of more than half their capacity. It is understood that the works have some billets in stock. The same class of material is made at several Sheffield works, which are, as well as North Lincolnshire, not affected by the dispute. There is no change to report in the position of the manufacturing side of the heavy steel trade, which is still well, though not fully, employed on railway axles, tires, springs and other material.

The Lighter Branches.

In the lighter departments of the steel trade the position is a great deal better than on the heavy side. In several directions a steady improvement has been in progress for a considerable time, and there are many works which are employed to the full extent of their capacity. Active conditions prevail generally at the tool-making works, and another factor which shows the progress of engineering is the increased call for high-speed steel, although that branch has not reached a full measure of prosperity. There is a growing demand for steel sheets, motor steel and files. The wire branch remains quiet, but this is attributed in part to seasonal influences. A continued improvement is reported in the trade in finished goods with overseas markets.

Cutlery and Plate.

In the cutlery trade a good demand is reported for stainless steel table knives, but the bulk of the business is in the cheaper qualities. At the same time, the demand for the better classes shows signs of improvement. The razor department does not make much progress. In many markets the popularity of the safety razor has had a serious effect on the trade in the old variety. In Australia, however, the standard Sheffield pattern is still preferred, and one local firm has a considerable amount of work on hand for the Commonwealth. The value of cutlery exports in July showed an increase of £30,000 as compared with June. The plate industry continues to turn out large quantities of spoons and forks, and there is a good demand for articles made of the new high-grade nickel silvers. There is a free sale for silver spoons, but in silver and plated hollow-ware generally, conditions are very quiet. The trade in Britannia metal ware continues very good. The works are well employed, and would be able to dispose of a larger output if the skilled labour needed for its production was available.

Omnibuses versus Trams.

The substitution of motor omnibuses for tramcars on one of the shorter tramway routes of Sheffield, referred to last week, was duly agreed to by the City Council. The change is an interesting one, though, of course, it does not suggest that the Corporation is about to embark on any large scheme of the kind. Mr. A. R. Fearnley, the general manager of the tramways, points out that tramcars and omnibuses have clear and distinct fields of operation, and Sir William Clegg, the chairman of the Tramways Committee, expresses the opinion that tramcars will not be superseded by omnibuses. Sir William, at the Council meeting, gave some additional information of interest with regard to the alteration. He pointed out that the omnibuses to be used will be of the latest type, accommodating fifty-two passengers, and that the total cost of running an omnibus is 3d. per mile less than that of a tramcar, largely owing to saving in capital expenditure. Complaints have been made on the ground that the omnibuses will be noisy and will splash mud about, but Sir William said these objections would be met by the use of pneumatic tires and by the laying of a clinker asphalt road which would give a smooth surface.

Sheffield Street Improvements.

A Provisional Order which has just received Royal Assent gives Sheffield Corporation power compulsorily to acquire certain lands for street improvements and new streets, and to put in hand a very large scheme. The application for the order was made last November, and a Ministry of Health inquiry with regard to it was held in February. The construction of several new streets is proposed, and a large number of widenings, enlargings and other improvements to present streets are scheduled. It is expected that some of the work will be put in hand during the coming winter, in order to relieve unemployment, but the full scheme will not be completed for three or four years. The total expenditure involved will probably be about £375,000.

Waterworks Extension at Hull.

An important extension of the Hull Corporation water undertaking is in progress at Dunswell, off the Beverley new road. The works, which are to provide a new supply to the city, will cost upwards of £500,000. The contractors are A. C. Potter and Co., of Grantham, and during the past year they have made considerable progress with the subterranean work. On the occasion of a visit by the Water Committee last week, Mr. P. Gaskell, the chairman, stated that they had decided to install an up-to-date oil engine plant, instead of steam. One reason was that it would be very expensive to transport coal to Dunswell. The oil fuel would be used instead, and would be conveyed from Hull by a land pipe which they had authority to lay from the quayside to the Dunswell works. Mr. R. Richardson, chairman of the Hull Corporation Finance Committee, mentioned that the expenditure on the new works would be met without increasing the water charges to the public.

Barnsley Seam at Thorne Colliery.

An important item of colliery development news is to hand in the report that a seam of coal, which is believed to be the Barnsley, has just been reached in the No. 1 shaft of Thorne new colliery, near Doncaster. This discovery crowns sinking operations which have been in progress for fifteen years, with an interruption of several years owing to the war, and which have been carried on in face of many difficulties, chief among these being the troubles caused by water-bearing strata, which were overcome by the cementation process. It was only as recently as June last that the Kent Thick seam, of a thickness of 5ft. 6in., was found at a depth of over 800 yards. This is a valuable seam, and would in itself justify the sinking of the pit, but the operations have been continued, and the new find has been made 921 yards below the surface. The colliery, when fully developed, will be a very large one. Plans are already prepared for the building of a village to house 10,000 people, to be ready in three years. A sewage scheme, costing £60,000, is to be carried out, and the education equipment will include a secondary school, to be erected by the County Council at a cost of £25,000. The colliery is situated on the main line to Hull, at a distance of 5 miles from the port of Goole.

The New Master Cutler.

This week the Cutlers' Company has elected its new Master, promoting to that ancient position Mr. W. W. Wood, jun., who during the past year has filled the office of Senior Warden. Mr. Wood is the sole active partner in the Wardsend Steel Company, a well-known Sheffield steel rolling and forging firm, which was founded in 1860 by his grandfather. On the completion of his education, Mr. W. W. Wood, jun., went into the North-Eastern Engineering Works at Sunderland to obtain training for his future career. He spent two years there as an ordinary workman, gaining a practical knowledge of the craft and an insight into the conditions of the working-man's life. On returning to Sheffield, he studied engineering and metallurgy at the Technical School—now the Applied Science Department of Sheffield University—and then joined his father's firm. Mr. Wood has already had experience of public work, having served on the Sheffield City Council for four years. He is a bachelor, and the duties of Mistress Cutler will be discharged by his aunt, Miss Gertrude Wood, J.P.

NORTH OF ENGLAND.

(From our own Correspondent.)

Menace of Foreign Competition.

Although at the moment there is a fair amount of activity in the shipbuilding and marine engineering industries on the North-East Coast, the outlook is anything but encouraging. Indeed, the fear is expressed that once present contracts are completed—and they are not expected to extend far into 1925—the outlook will be as black as it was a year ago. Orders are not coming forward to replace those being worked off. Foreign competition, particularly German, is having a very grave effect. With English forgings anything up to 50 per cent. higher in price that the German products, the plight of those in control of shipbuilding and marine establishments can well be imagined. It is such factors as these that are raising insuperable difficulties in the way of obtaining orders. For instance, with regard to a set of marine engines for an ordinary steamer, such as might be built at any of the North-East Coast yards, the difference in the total cost effected by using German forgings alone would be between £800 and £1000, according to the size of the set. Another adverse factor is the freightage question. During the past few months, vessels which have been completed have remained at the shipyard wharves for weeks on end because there was no work for them.

The Brighter Side.

In constructional engineering circles, however, the position is decidedly more hopeful, several establishments being well supplied with work. The Power Gas Corporation, Limited, which is associated with Ashmore, Benson, Pease and Co., Limited, the well-known Tees-side firm, has just booked orders to the value of over £150,000. A local firm has ordered from it three waste heat boilers to work in conjunction with mechanical water gas generators, rated at 2,000,000 cubic feet of gas per day. From the same company this firm has also secured a contract for the erection of a coke gas producer plant, to generate 3,500,000 cubic feet of gas per day for process work. Other important orders obtained by the firm include a coal gas retort generator plant for the Yokohama Gasworks, and gas power plant to be erected in Northern Rhodesia for the Bwana M'Kubwa Copper Mining Company, Limited.

Cleveland Iron Trade.

Business still rules on quiet lines in the Cleveland pig iron trade, but the position is, nevertheless, a little more hopeful. The steady improvement in the continental exchanges has not yet gone far enough to give British makers free access to European markets, but the position is changing in their favour, and if the movement continues there are hopes of a recovery in the export trade. There was no market this week consequent upon the annual trade holidays, and with these out of the way it is expected that autumn buying will commence. There is a growing feeling that the worst of the depression has been experienced, and with the possibility of conditions becoming more favourable, orders that have been held up are expected to be released. Makers still quote 90s. for No. 1 foundry iron, 85s. for No. 3 G.M.B. Cleveland pig iron, 84s. for No. 4 foundry, and 83s. for No. 4 forge for export, and f.o.t. lots can be bought at 6d. per ton less.

Hematite Pig Iron.

East Coast hematite pig iron is slow of sale, and the statistical situation in this branch is gradually becoming worse. Makers are hampered by large and steadily increasing stocks, and values still show rather a downward trend. For mixed numbers, sellers quote 93s., and for No. 1 93s. 6d., but buyers state that these figures can be shaded.

Ironmaking Materials.

There is little movement in the foreign ore trade, consumers having large stocks already on hand, but sellers continue to base market rates on 22s. 6d. per ton c.i.f. for best Rubio. Blast-furnace coke is in only moderate request, and values are easy. Good medium qualities are in the neighbourhood of 26s. per ton delivered at the works.

Manufactured Iron and Steel.

Order books of finished iron and steel manufacturers are in anything but a satisfactory state, and with contracts on hand fast approaching completion, and orders very scarce, a good deal of apprehension is felt concerning the near future. The one department really busy is the sheet-making branch. Producers are heavily sold, and, indeed, are so well placed that they are not anxious to secure further contracts for this year's delivery. Overseas quotations for most manufactured iron and steel materials cannot well be fixed, competition for orders being keen, and prices being a matter of individual negotiation. Steel plates are reported obtainable for local use at 10s. below the prices named for delivery to home consumers at a distance.

The Coal Trade.

All sections of the Northern coal trade are now showing a more optimistic tone, operators being inclined to think that the recent slump has touched bottom, and prospects are pointing to a recovery. The political agreement with France and Germany is regarded as pointing to a distinct improvement, and prospects of very substantially increased German demand, which of itself would strengthen the market. Another factor is the strike in the Belgian coalfields, and whilst that country is stocked with coals, these are only expected to last a month, and should the strike last a few weeks, the Belgian consumers would have to come on to this market for extensive quantities. The tone of the Northumberland steam coal section is fully steady, and for prompt prices is showing a firm undertone. The gas coal trade is quiet at the moment, but with the usual September demands likely to set in, quotations are firm. The coke trade is quiet, but whilst the demand remains firm, the production of all grades is abundant, and values remain just steady.

New Furnace Put Into Operation.

Dorman, Long and Co., Limited, have this week blown in a new furnace at their Warrenby Ironworks to replace another one of the older type which has been put out of operation at the Carlton Works. The new furnace is built on modern lines, and is designed to give a greatly improved output.

SCOTLAND.

(From our own Correspondent.)

Unchanged Conditions.

The industrial situation on the whole remains much the same as in the first half of the year, and the long-looked-for improvement in business is still in the future. In practically all branches of the steel and iron trades business is extremely disappointing. Neither prompt nor forward inquiries are of any great consequence. Home prices are mostly unchanged, and though producers are inclined to ease quotations for export, the amount of business on offer hardly warrants a substantial reduction in price. Offers of foreign materials are still fairly numerous, but it is said that very little advantage is being taken of this opportunity to obtain supplies at cheaper than home prices. Generally speaking, employment is

irregular, and some producers have difficulty in keeping works employed at all.

Scarcity of New Business.

The lack of specifications for steel plates and sections is still pronounced. Orders for plates are very far below expectations, considering the amount of new tonnage placed on the Clyde during the past month or two. No doubt the prices ruling have something to do with this lack of orders, but producers evidently do not see their way to make any reductions in the meantime, at least. Steel sections are in much the same position. Now and then a fair order for constructional steel has been mentioned, but the average turnover in this material also is disappointing. Bar iron is poor, meantime. The amount of tonnage secured recently shows no improvement, and the immediate outlook is not encouraging.

Smaller Output of Pig Iron.

There is a strong likelihood of a decrease in the production of pig iron in view of the poor demand experienced at present. Prices have struck an easier tendency, and for some weeks past quotations have steadily declined without bringing any improvement in the turnover. Foundry qualities in particular are poorly bought, and hematite is little, if any, better off. Unless an appreciable improvement is experienced in the very near future, some furnaces are likely to be put out of blast.

Steel Sheets.

The continued demand for thin steel sheets provides the bright spot in an otherwise dull market. The majority of the works have well-filled order books, and in some instances are booked to the end of the year at least. Galvanised flat and corrugated varieties are especially firm.

Coal.

The market for Scotch coal has been a moderate one. The demand has been somewhat uneven, and prices have fluctuated a little. Round fuel was not quite so busy as in the preceding week, while treble nuts were rather better. Lanarkshire ells were firmly quoted up to 20s. 6d. per ton, with best navigation steams up to 26s. per ton. Splints were not quite so well placed. Treble nuts were moderately steady at 22s. 3d. to 22s. 6d. per ton. Fifeshire screened navigations averaged 26s., but 27s. per ton was paid, while unscreened was sold up to 24s. 6d. per ton. Treble nuts were a very strong feature, as much as 24s. 6d. being offered. Supplies of these were, however, very short. Fifeshire steams sold at 20s., and averaged 19s. 6d. to 19s. 9d. for best and 15s. per ton for third-class qualities. Lothians steams were a shade easier. Aggregate shipments amounted to 271,552 tons, against 272,287 tons in the preceding week, and 329,637 tons in the same week last year. Fair quantities of Ayrshire fuels were sold for shipment to Ireland, ordinary screened steam selling at 19s. 6d. per ton. The home demand for coal, especially for industrial purposes, is slow. House coal was quoted 23s. and best brands 27s. per ton.

WALES AND ADJOINING COUNTIES.

(From our own Correspondent.)

Coal Trade Conditions.

FAIRLY active is the condition which can be said to apply to the steam coal trade at the present time, though it cannot be reported that there is material pressure. The position on the whole is better than has been the case recently, and this is evident from the improved tonnage supplies. As the result of satisfactory arrivals of steamers over last week-end, there were just over thirty vessels waiting their turn to load, though there were also a number of idle berths. The collieries are in a more comfortable position, and doubtless this is brought about by the fact that those working are reaping some benefit as a consequence of the pits that have been closed. Naturally, some dissatisfaction exists in those areas which are adversely affected as the result of the suspension of operations, and it is to be noted that one of the South Wales miners' leaders has returned to the advocacy of the scheme for the limitation of output in times of depression in order to bring about the more equitable distribution of labour and to maintain prices. There are two sides to this question, however, and opponents of it will readily assert that this scheme would have the effect of seriously curtailing our export trade, and would permit of other coalfields successfully competing for foreign business to a greater extent even than at the present time. It would also mean less work for the railways and at the docks, there would be less coal to be carried, and reduced employment for tonnage, and shipowners would expect to make up to some extent in the homeward freight, thus increasing the cost of imported goods. While the demand for steam coals is moderately good, there is no material improvement upon the conditions of a week ago, but the anthracite coal section is relatively better, and the loading pressure at Swansea is fairly considerable, as may be gauged from the fact that nearly a score of steamers are waiting for their turn to load, and there are few qualities of coal that cannot be described as firm.

Coalfield Stoppages.

Although hopes had been entertained by the workmen that a stoppage would have been averted, these are apparently doomed to disappointment, and it was reported in the early part of this week that the Cambrian collieries at Clydach Vale would be closed down as from Wednesday of this week, while there is no prospect of their re-opening until the state of trade considerably improves. Over 3000 miners are affected by this suspension of operations. In the Avon Valley a similar number of miners are unemployed, and in the Garw district about 1500 men are out of work. In the Merthyr district about 700 miners received notices at the end of last week to terminate their employment, and in other areas there are reports of possible stoppages. In the case of the Deep Navigation Colliery, Treharris, the men themselves threatened to bring about the suspension of work on the non-unionist question, as they have handed in notices to terminate employment. At this pit there are about 2000 men engaged.

Dry Dock Deadlock.

During the latter part of last week the wages dispute between the dry dock employers in the Bristol Channel and the members of the Amalgamated Engineering Union came to a head. It had been known for some time previously that the position was becoming critical. The wages question had been settled with the representatives of the other workmen, but the final terms offered by the employers to the members of the A.E.U., which were recommended for acceptance by the leaders of that organisation, were rejected when submitted to mass meetings at the principal ports. The result was that on Thursday of last week the employers posted up notices that as from Monday of this week employment would be open to members of the Amalgamated Engineering Union upon the basis that there was a complete removal of the embargoes with respect to overtime working and employment of chargemen, and there would be a special bonus at the rate of 5s. per week of forty-seven hours, to take effect in two instalments, viz., 2s. 6d. as and from Monday, August 18th, and 2s. 6d. as from Wednesday, October 1st. As a matter of fact, the final offer made to the men at the last conference between the two parties was that the first instalment would operate as from July 1st. As, however, the terms were rejected there has been no work on the part of the members of the A.E.U. this week. The members include fitters, turners, coppersmiths, patternmakers, &c., and about 1200 men were at once directly affected, but there are altogether about 10,000 workmen employed in the ship-repairing industry in the Bristol Channel. At a fair estimate, it is stated that there have been about 3000 to 4000 men idle this week, though this number is certain as time goes on to increase, until the whole industry becomes affected. Trade is at the present time quiet, but there is no doubt that the employers, in view of the unfortunate situation which has been developing, have been holding off orders, and now that the dispute has led to a stoppage with this important section, they are quite unable to entertain any work which means the employment of fitters, &c. It is impossible to say how long the dispute will last, and in the meantime shipowners who require work to be done on their ships will either defer repairs wherever possible, or else send their tonnage to other districts, which may mean that there will be less tonnage on offer for freight from this district. Owners will naturally look for cargoes from the ports where they are having their ships repaired, and thus avoid an expensive move, so that if the stoppage is of lengthy duration it may adversely affect the coal trade.

Government Inquiry into Industry.

Coal exporters in this district have manifested surprise that the coal trade, and more especially the export side of it, are unrepresented on the Government Committee of Inquiry into Industry and Trade. Their view is that this basic industry should have adequate representation by an expert, and therefore the South Wales Coal Exporters' Association took steps to ascertain the reason for this omission, and got into touch with the British Coal Exporters' Federation in London, which body communicated with the Board of Trade. The reply received was that the members of the Committee have been invited to serve in their individual capacities, and not as nominees or representatives of particular interests or organisations. In the circumstances, therefore, the question of adding members to the Committee for the representation of specific trades does not arise, but the Committee will no doubt take all steps necessary to enable it to ascertain and give adequate consideration to the views of those concerned in the coal export trade. This reply is, however, not considered at all satisfactory, and it is understood that the coal exporters do not intend to let the matter rest where it is.

The Tin-plate Industry.

The adjourned annual meeting of the Joint Industrial Council for the Welsh Plate and Sheet Trade was held last week, and it is satisfactory to record that its reputation for conciliatory methods has been maintained. The constitution has been amended to deal more expeditiously with disputes, and the original claims which were submitted by the workmen were reduced from seventy-one to twenty-one. A few of these were conceded, either in whole or in part, and the others were referred to the Standing Joint Committee. These included the scheme for a superannuation fund for aged workmen, the payment of all workers during the annual week's holiday, and the proposal that all datal workmen over twenty-one years of age should be paid a gross weekly wage of 55s.

Current Business.

The tone of the steam coal market has been somewhat quiet, though a fair amount of business has been done in the circumstances. The conditions are steadier, and promise to become better, in view of the rather numerous stoppages in the coalfield. Best Admiralty large are quoted up to 29s., and small coals of the best bunker descriptions are steadier. Patent fuel and coke are unchanged, but it is noteworthy that the Crown patent fuel works at Port Talbot are being reopened, which means the immediate employment of about 250 workmen. Anthracite coals are firmer, with the possible exception of rubbly culm.

20-Ton All-steel Railway Wagon.

The Cambrian Wagon Company, Limited, East Moors-road, Cardiff, has on view at its works a sample 20-ton all-steel railway coal wagon. This wagon, which is fitted with two side and two end doors and is of the tipping type, has been constructed by the Cambrian Company to the Railway Clearing House specifications and drawings, and is the first of its kind to be built in South Wales. It is registered for main-line traffic by the Great Western Railway Company, which, I understand, offers a rebate of 5 per cent. in the railway rates in respect of coal conveyed over its system in wagons of that capacity.

CATALOGUES.

BRITISH EMPIRE EXHIBITION, 1924.—Official guide. London: Fleetway Press, Limited. Price 1s.

HANS RENOLD, Limited, Burnage Works, Didsbury, Manchester.—New edition of booklets on "Notes on the Selection of Chain Gear" and "Chains and the Machine Tool."

E. GREEN AND SON, Limited, Economiser Works, Wakefield.—Illustrated souvenir of Green's patent fuel economiser.

S.R.O. BALL BEARING COMPANY, 115, Southwark-street, S.E.—Catalogue No. 15 of ball races, roller bearings and thrusts.

TROLLOPE AND COLLS, Limited (Engineering Department), 5, Coleman-street, E.C.—Pamphlet on water towers and their cost.

J. BLAKEBOROUGH AND SONS, Limited, Brighouse, Yorks.—Pamphlet entitled "Why Blakeborough Valves are Supreme."

GEAR GRINDING COMPANY, Limited, Handsworth, Birmingham.—Pamphlet on gear tooth grinding for electric railway gears.

F. GILMAN (B.S.T.), Limited, Grange Works, Grange-road, Smethwick.—Descriptive leaflets on the Skatoskalo electric scaling tool.

ALFRED HERBERT, Limited, Coventry.—The eighth edition of Herbert's small tools catalogue. This catalogue contains over 500 pages profusely illustrated.

SULLIVAN MACHINERY COMPANY, Chicago.—Bulletin 71 H, being a new handbook on air lift pumping equipment, also air lift boosters or re-lift apparatus.

DAVID BROWN AND SONS (Huddersfield), Limited, Lockwood, Huddersfield.—Card on carburising, gear tooth verniers, and "fixed jaw" gear tooth callipers.

WELLMAN SMITH OWEN ENGINEERING CORPORATION, Limited, 36/38, Kingsway, W.C. 2.—Section V., Part X., of catalogue of Wellman mechanical gas producer.

WESTINGHOUSE BRAKE AND SAXBY SIGNAL COMPANY, Limited, 82, York-road, King's Cross, N. 1.—Catalogue Section 89 of double-wire signalling for British and colonial railways.

BRUSH ELECTRICAL ENGINEERING COMPANY, Limited, Falcon Works, Loughborough.—Leaflet 200/5-1a, which illustrates and describes a new transformer development—a high-tension oil-immersed tapping switch.

ENGLISH ELECTRIC COMPANY, Limited, Queen's House, Kingsway, W.C. 2.—Publication 535, entitled "A Three-high Plate Mill at the Clydebridge Works of David Colville and Sons, Limited." Publication 536 on 15,000 horse-power water turbines.

A. H. GOLDINGHAM, 53, Victoria-street, S.W. 1.—Pamphlets on "Icemaking Economy with Oil Engines," "Brunswick Standard Icemaking Machines," and De la Vergne ammonia condensers and high-speed installations. Folder on the Indico system of icemaking.

PERSONAL AND BUSINESS ANNOUNCEMENTS.

THE Hamworthy Engineering Company, Limited, asks us to announce that it has opened a branch office at 103, West Regent-street, Glasgow.

WE are asked to state that the address of the British Goodrich Rubber Company, Limited (late the B. F. Goodrich Company, Limited), is 50, Pall-mall, London, S.W. 1.

THE Victaulic Company, Limited, asks us to announce that as from August 23rd the address of its registered offices will be King's Buildings, Dean Stanley-street, Westminster, S.W. Its telegraphic address will be changed to Victaulic, Parl, London.

MESSRS. GRAZIANI AND CO., Limited, of 110, Fenchurch-street, London, E.C. 3, ask us to state that they have been appointed agents in this country for the "Ansaldo" S. A. of Genoa, Italy, which has taken over the works formerly belonging to Messrs. Gio Ansaldo and Co.

WE are asked to announce that the London address of the Ransome and Marles Bearing Company, Limited (of Newark-on-Trent), has been changed from 64, Mortimer-street, Gt. Portland-street, W. 1., to 17, Victoria-street, Westminster, S.W. 1. New telegraphic address, Offialunda, Sowest, London, and new telephone number, Victoria 3982.

MR. J. S. JONES, vice-president of Chas. Cory and Son, Inc., electrical engineers and contractors, of 183, Varick-street, New York, asks us to state that he is on a visit to this country and will be glad to receive catalogues and descriptive data relative to power and industrial equipment, which can be manufactured and sold in the United States. His address is c/o Old Colony Club, 7, Haymarket-street, London.

ERRATUM.—Through a regrettable slip of the pen the name of the maker of the cradles for the Train Ferry Service across the Benue River, Nigeria, was, at the head of the illustrations on page 186 of our last issue, given as being the Horseley Company, Limited. It should, of course, have been the Horsehay Company, Limited, as was stated in the text.

VACANCIES FOR AIRCRAFT APPRENTICES.—The Air Ministry announces, in continuation of the policy of training aircraft apprentices in the skilled trades of the Royal Air Force—that two examinations for the entry in January, 1925, of over 500 suitable boys who are physically fit and who will be between the ages of 15 and 16½ at the time of entry, will be held on October 17th and November 4th respectively. The closing date for the receipt of completed forms of application for the first examination, which is an "open" competition conducted by the Civil Service Commissioners, is August 28th, while for the second "limited" competition, which is carried out by the Air Ministry in conjunction with local education authorities of the country, the forms of nomination must be received in the Air Ministry by October 7th. Candidates for the Civil Service "open" competition should apply for forms of application to the secretary, Civil Service Commission, Burlington-gardens, London, W. 1. For the "limited" competition, boys who are still at school should apply to their headmasters with a view to securing a nomination from the education authority responsible for the school. If they have left school they should apply to the Advisory Committee for Juvenile Employment in their area, while Boy Scouts can also apply to the authorities of the Boy Scout Association, and Territorial Cadets to the officers commanding their units.

Current Prices for Metals and Fuels.

IRON ORE.

N.W. Coast—	
Native	17/6 to 24/-
(1) Spanish	23/-
(1) N. African	23/-
N.E. Coast—	
Native	—
Foreign (c.i.f.)	22/6

PIG IRON.

	Home. £ s. d.	Export. £ s. d.
(2) Scotland—		
Hematite	4 16 3	—
No. 1 Foundry	4 18 9	—
No. 3 Foundry	4 13 9	—
N.E. Coast—		
Hematite Mixed Nos.	4 12 6	4 12 6
No. 1	4 13 0	4 13 0
Cleveland—		
No. 1	4 9 0	4 9 0
Silicious Iron	4 9 0	4 9 0
No. 3 G.M.B.	4 4 0	4 4 0
No. 4 Foundry	4 3 0	4 3 0
No. 4 Forge	4 2 0	4 2 0
Mottled	—	—
White	—	—
Midlands—		
(2) Staffs.—		
All-mine (Cold Blast)	9 2 6	—
North Staffs. Forge	4 0 0	—
„ „ Foundry	4 7 6	—
(2) Northampton—		
Foundry No. 3	4 2 6	
„ Forge	3 17 0	—
(2) Derbyshire—		
No. 3 Foundry	4 5 0 to 4 7 6	
Forge	4 0 0 to 4 2 6	
(2) Lincolnshire—		
No. 3 Foundry	4 10 0 to 4 12 6	—
No. 4 Forge	4 12 6 to 4 15 0	—
Basic	4 8 0 to 4 10 0	
(4) N.W. Coast—		
N. Lancs. and Cum.—		
Hematite Mixed Nos.	5 10 0 (a) / 5 15 0 (b)	—

MANUFACTURED IRON.

	Home. £ s. d.	Export. £ s. d.
Scotland—		
Crown Bars	12 10 0	—
Best „	—	—
N.E Coast—		
Common Bars	12 10 0	—
Lancs —		
Crown Bars	13 0 0	—
Second Quality Bars	12 0 0	—
Hoops	15 0 0	14 15 0
S. Yorks.—		
Crown Bars	13 10 0	—
Best „	14 0 0	—
Hoops	15 0 0	—
Midlands—		
Crown Bars	13 0 0	—
Marked Bars (Staffs.)	15 0 0	—
Nut and Bolt Bars	12 0 0	—
Gas Tube Strip	13 5 0 to 13 7 6	—

STEEL.

	(6) Home. £ s. d.	(7) Export. £ s. d.
(5) Scotland—		
Boiler Plates	13 10 0	—
Ship Plates, ½in. and up	10 5 0	—
Sections	10 0 0	—
Steel Sheets, 3/16in. to ½in.	12 10 0	—
Sheets (Gal. Cor. 24 B.G.)	—	18 10 0

STEEL (*continued*).

	Home. £ s. d.	Export. £ s. d.
N.E. Coast—		
Ship Plates	9 15 0	—
Angles	10 0 0	—
Boiler Plates	13 10 0	—
Joists	10 0 0	—
Heavy Rails	9 0 0	—
Fish-plates	13 0 0	—
Channels	10 5 0	£9 to £9 5
Hard Billets	9 10 0	—
Soft Billets	8 10 0	—
N.W. Coast—		
Barrow—		
Heavy Rails	9 5 0†	—
Light „	9 10 0 to 10 0 0†	
Billets	8 10 0 to 12 0 0†	
Manchester—		
Bars (Round)	10 5 0 to 10 15 0	
„ (others)	10 0 0 to 10 2 6	
Hoops (Best)	15 5 0	15 0 0
„ (Soft Steel)	13 15 0	13 10 0
Plates	10 0 0 to 10 5 0	—
„ (Lancs. Boiler)	13 10 0	—
Sheffield—		
Siemens Acid Billets	12 10 0	—
Bessemer Billets	13 0 0	—
Hard Basic	9 10 0	
Intermediate Basic	9 0 0	
Soft Basic	8 5 0 to 8 10 0	
Hoops	12 10 0 to 13 0 0	
Soft Wire Rods	11 0 0 to 11 10 0	
Midlands—		
Small Rolled Bars	9 15 0 to 10 10 0	
Billets and Sheet-bars	7 12 6 to 7 15 0	
Sheets (20 W.G.)	11 10 0 to 12 0 0	
Galv. Sheets, f.o.b. L'pool	18 5 0	—
Angles	9 15 0 to 10 0 0	
Joists	9 15 0 to 10 0 0	
Tees	10 15 0 to 11 0 0	
Bridge and Tank Plates	10 10 0	—
Boiler Plates	14 0 0	—

NON-FERROUS METALS.

Swansea—	
Tin-plates, I.C., 20 by 14	22/7½ to 23/-
Block Tin (cash)	255 15 0
„ (three months)	256 15 0
Copper (cash)	63 7 6
„ (three months)	64 7 6
Spanish Lead (cash)	33 0 0
„ (three months)	32 3 9
Spelter (cash)	32 12 6
„ (three months)	32 6 3
Manchester—	
Copper, Best Selected Ingots	69 10 0
„ Electrolytic	70 10 0
„ Strong Sheets	94 0 0
„ Tubes (Basis price)	0 1 1½
Brass Tubes (Basis price)	0 1 0
„ Condenser	0 1 2½
Lead, English	35 10 0
„ Foreign	34 15 0

FERRO ALLOYS.

(*All prices now nominal.*)

Tungsten Metal Powder	1/8½ per lb.	
Ferro Tungsten	1/4½d. per lb.	
	Per Ton.	Per Unit.
Ferro Chrome, 4 p.c. to 6 p.c. carbon	£24 0 0	10/6
„ 6 p.c. to 8 p.c. „	£23 10 0	8/-
„ 8 p.c. to 10 p.c. „	£23 0 0	8/-
„ Specially Refined		
„ Max. 2 p.c. carbon	£42 10 0	16/-
„ „ 1 p.c. „	£51 0 0	17/6
„ „ 0.75 p.c. carbon	£68 0 0	20/-
„ „ carbon free	1/5 per lb.	
Metallic Chromium	4/2 per lb.	
Ferro Manganese (per ton)	£15 for home, £15 for export	
„ Silicon, 45 p.c. to 50 p.c.	£12 0 0 scale 5/- per unit	
„ „ 75 p.c.	£18 10 0 scale 6/- per unit	
„ Vanadium	19/3 per lb.	
„ Molybdenum	8/3 per lb.	
„ Titanium (carbon free)	1/3 per lb.	
Nickel (per ton)	£135	
Cobalt	10/6 per lb.	
Aluminium (per ton)	£120 to £130	

FUELS.

SCOTLAND.

	Export.
Lanarkshire—	
(f.o.b. Glasgow)—Steam	18/6
„ „ Ell	20/3
„ „ Splint	21/6 to 24/-
„ „ Trebles	22/6
„ „ Doubles	18/-
„ „ Singles	16/6
Ayrshire—	
(f.o.b. Ports)—Steam	18/6
„ „ Splint	21/6
„ „ Trebles	22/6
Fifeshire—	
(f.o.b. Methil or Burntisland)—Steam	15/6 to 20/-
Screened Navigation	26/-
Trebles	24/-
Doubles	18/3
Singles	16/6
Lothians—	
(f.o.b. Leith)—Best Steam	18/3
Secondary Steam	17/3
Trebles	23/3
Doubles	18/3
Singles	16/6

ENGLAND.

(3) N.W. Coast—	
Steams	28/6
Household	45/- to 58/4
Coke	33/6
Northumberland—	
Best Steams	20/6 to 21/-
Second Steams	18/6 to 19/-
Steam Smalls	10/6
Unscreened	16/- to 17/-
Household	27/6
Durham—	
Best Gas	22/6 to 23/-
Second	19/- to 19/6
Household	27/6
Foundry Coke	25/- to 26/-
Sheffield—	Inland.
Best Hand-picked Branch	32/- to 35/- —
Barnsley Best Silkstone	26/- to 28/- —
Derbyshire Best Brights	25/- to 27/- —
„ „ House	23/- to 25/- —
„ „ Large Nuts	21/- to 25/- —
„ „ Small „	15/- to 17/6 —
Yorkshire Hards	21/6 to 22/6 —
Derbyshire „	21/- to 23/- —
Rough Slacks	12/6 to 15/6 —
Nutty „	12/- to 14/- —
Smalls	7/- to 9/- —
Blast-furnace Coke (Inland)*	— —
„ „ (Export)	f.o.b. 27/-

(9) SOUTH WALES.

Cardiff—	
Steam Coals:	
Best Smokeless Large	28/- to 29/-
Second „ „	27/- to 28/-
Best Dry Large	26/6 to 27/-
Ordinary Dry Large	25/- to 26/-
Best Black Vein Large	26/6 to 27/-
Western Valley „	26/- to 26/6
Best Eastern Valley Large	25/- to 26/-
Ordinary „ „	24/- to 25/-
Best Steam Smalls	17/- to 18/-
Ordinary „	14/6 to 16/6
Washed Nuts	25/- to 27/-
No. 3 Rhondda Large	27/- to 28/-
„ „ Smalls	20/- to 22/-
No. 2 „ Large	23/- to 24/-
„ „ Through	19/- to 21/-
„ „ Smalls	14/- to 15/-
Foundry Coke (export)	47/6 to 55/-
Furnace Coke (expor.)	32/6 to 37/6
Patent Fuel	27/- to 29/-
Pitwood (ex ship)	30/6 to 31/-
Swansea—	
Anthracite Coals:	
Best Big Vein Large	50/- to 52/6
Seconds	42/6 to 45/-
Red Vein	30/- to 32/6
Machine-made Cobbles	57/6 to 60/-
Nuts	52/6 to 60/-
Beans	39/- to 41/-
Peas	23/- to 25/-
Breaker Duff	10/9 to 11/-
Rubbly Culm	13/6 to 14/-
Steam Coals:	
Large	24/- to 25/-
Seconds	22/- to 23/-
Smalls	14/- to 16/6
Cargo Through	18/- to 20/-

(1) Delivered. (2) Net Makers' works. (3) f.o.t. Makers' works, approximate. (4) Delivered Sheffield. (5) Glasgow, Lanarkshire, and Ayrshire.

(6) Home Prices—All delivered Glasgow Station. Boiler Plates 10/- extra delivered England. (7) Export Prices—f.o.b. Glasgow.

(8) Except where otherwise indicated, coals are per ton at pit for inland and f.o.b. for export, and coke is per ton on rail at ovens and f.o.b. for export. (9) Per ton f.o.b.

* For blast furnaces only, 21/- to 25/-; open market, 27/6 to 28/6. † Latest quotations available. (a) Delivered Sheffield or Glasgow. (b) Delivered Birmingham.

French Engineering Notes.

(From our Correspondent in Paris.)

Workmen's Dwellings.

So difficult is it to procure steady labour that employment in districts more or less isolated from the populous centres are obliged to construct dwellings for their hands, and many large works in the country have the appearance of small towns. Considerable sums of money are being devoted to the building of houses, and while representing a heavy charge, the expenditure is, nevertheless, regarded as a good investment, in the sense that it permits of the selection of men with families who remain at their jobs. It is found that in works where housing accommodation is provided there are no labour troubles. Employers therefore consider that the placing of houses at the disposal of the men with families offers the real solution of the labour problem. Around Paris it was hoped to obtain the same results by the construction of garden cities for the working classes. The Department of the Seine has created many such cities in the suburbs, each of them being laid out on different lines with different methods of building construction and materials, the idea being that in the course of a few years valuable experience will be acquired as to the relative durability of the houses and their habitability. Although so much has been done, it has failed so far to relieve the housing difficulty, and the Municipal Council of Paris has therefore voted a sum of 300 million francs to continue the construction of garden cities on a much larger scale. Some of them will be laid out on the site of the fortifications which are now being levelled. The Chamber of Deputies has approved of the vote, and the failure of the Senate to confirm this before the end of the session is much criticised, for it is argued that the housing problem for the working classes is one that cannot be allowed to remain in abeyance. At the same time, measures are being taken to provide for the housing and control of the considerable number of workers who are being imported from North Africa. This class of worker presents a social problem of its own. The Kabyle will do work more or less indifferently which the Frenchman refuses to do at all, but he does not seem amenable to improvement, although well treated and earning high wages, and the self-ostracism of the North Africans has obliged the Government to create a special organisation for them.

Salving a Concrete Boat.

The use of ferro-concrete in the construction of boats was a temporary expedient during the war, and in view of the claims made on behalf of this method of small tonnage shipbuilding, it was continued for some time after the Armistice. Some concrete boats are still in service, from which it may be concluded that the objections raised against the concrete construction was scarcely more justified than the somewhat exaggerated advantages claimed with regard to cost. The chief objection was an alleged liability to fracture under shock. There seems to have been little evidence of such fragility, and the defect was certainly lacking in a large concrete boat which sank in the port of Rouen in May, 1923. It was carrying a load of 600 tons of sulphur, which was removed after the accident. The sinking was not due to any damage to the hull, which remained intact. In an effort to refloat the boat, caissons were built around it, but an attempt towards the end of the year to bring it to the surface failed. During the winter the boat sank deeply in the bottom of the river, and great quantities of mud accumulated in the hull. A special pump was constructed to remove the mud from the hull and around the outside. The operation, which lasted a month, was completed towards the end of July, and another attempt was made to raise the vessel. As soon, however, as it left the river bed, it took a strong list to port, and it had to be dropped to prevent capsising. Powerful lifting tackle was then brought into service, but when the pumps were again put in operation the boat took a list to starboard, which necessitated its being lowered to the bottom again. Finally, the operation was successfully accomplished by placing a 1000-ton barge on one side of the boat, and the floating cranes on the other, so that the vessel was maintained in a vertical position until it rose sufficiently to float.

Electrification of Morocco.

If the agricultural and industrial development of Morocco has so far fallen short of expectations, it cannot be attributed to any lack of enterprise on the part of the French in opening up the country with roads and railways. Road construction is being pushed forward with great activity upon a definite plan, which aims at carrying the products from the different centres to the ports of shipment. Electricity is to be employed on a large scale for agriculture, industrial and traction purposes. At Casablanca a generating station with three turbo-alternators, each of 6000 kilowatts, will be completed by the end of the year. A hydro-electric station is to be installed at a distance of about 45 kiloms. from the mouth of the Oum-er-Rebia, where a head of water of from 15 m. to 17 m. will provide from 11,000 to 13,000 kilowatts. The current will be distributed over half a dozen mains, having a total length of 635 kiloms. Two of the mains from Casablanca are now being installed.

Pulverised Coal.

Owing to the friable nature of most of the coal mined in this country, there is a very large percentage of dust, which has so far been utilised in the manufacture of briquettes. The making of briquettes has therefore become a very important industry. It appears likely that briquette firms will have to pay much more for their coal dust, or will be obliged to make a larger use of peat and other substitutes now that there is a growing demand for small coal for raising steam with pulverised fuel. Many of the steam-raising plants now being laid down are equipped to use pulverised coal, and the system appears to be making steady headway on account partly of the lower cost of the small coal, the stocks of which at the collieries are considerable.

British Patent Specifications.

When an invention is communicated from abroad the name and address of the communicator are printed in italics.

When an abridgment is not illustrated the Specification is without drawings.

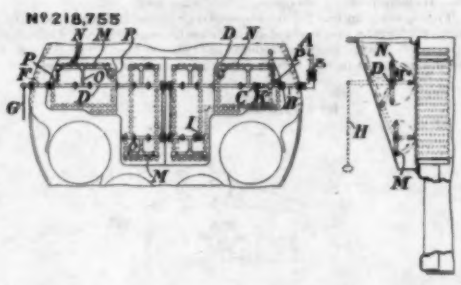
Copies of Specifications may be obtained at the Patent Office Sale Branch, 25, Southampton-buildings, Chancery-lane, W.C., at 1s. each.

The date first given is the date of application; the second date, at the end of the abridgment, is the date of the acceptance of the complete Specification.

STEAM GENERATORS.

218,755. April 13th, 1923.—Improvements in Apparatus for Removing Soot from Steam Boilers, Norman Emile McClelland, of 41, Eastcheap, London, E.C. 3.

This invention relates to an improved construction of apparatus for dealing with the removal of soot from the smoke-box of boilers having three or more furnaces, the central furnace or furnaces being at a lower level than the wing furnaces. The steam is supplied to the blower jets through a pipe A, controlled by valves in communication with a fixed pipe B, which is connected by a swivelling joint C, with the jet supply pipe D, which extends across the upper part of the smoke-box. The jet supply pipe is closed at its farther end and coupled with a spindle F, which is journalled in bearings in the walls of the air duct, and extends outside the smoke-box. A crank arm G on the protruding end of the spindle is operable by means of a rod H to rotate the jet supply pipe D. A branch pipe K from the fixed pipe B leads to a second swivelling joint I and thence to a second jet supply pipe, extending transversely across the central dropped part of the smoke-box. The farther end of this pipe is closed and supported in a bearer or journal secured to the wall of the smoke-box. The pipe is rotated simultaneously with

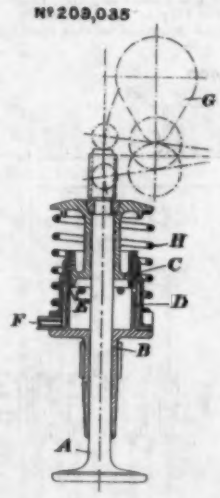


the pipe D, and by the same lever through chain gearing, so that for either direction of rotation of pipe D, one or other of the chains will be in tension. The nozzle pipes M are carried by T-branches O from the upper and lower jet supply pipes respectively, the nozzles N of the upper nozzle pipes projecting upwards, while those of the lower nozzle pipes project downwards. This is one of the normal positions of the apparatus. The other positions, shown in dotted lines, are positions which can be assumed by the jet pipes in operation. In one of these positions the jets of the series of pipes are directed downwards, while the jets of the lower series are directed upwards, and in the intermediate position the jets are directed towards the smoke-box ends of the fire tubes. In the two wing sections of the furnace, the jet pipes are shown provided with supplementary nozzles P at a different level from the nozzles N, but turned in the same direction. It will be seen that in this construction only the steam connection of the upper jet supply pipe and the operating spindle extend across the air ducts of the furnace, the fixed steam supply pipe for the lower jet pipe and the latter being enclosed entirely within the smoke-box. The air ducts may, however, be left entirely free by an alternative arrangement.—*July 14th*, 1924.

INTERNAL COMBUSTION ENGINES.

209,035. October 6th, 1923.—Improvements relating to the Valves of Internal Combustion Engines, Société Anonyme des Ateliers d'Aviation Louis Breguet, 115, Rue de la Pompe, Paris.

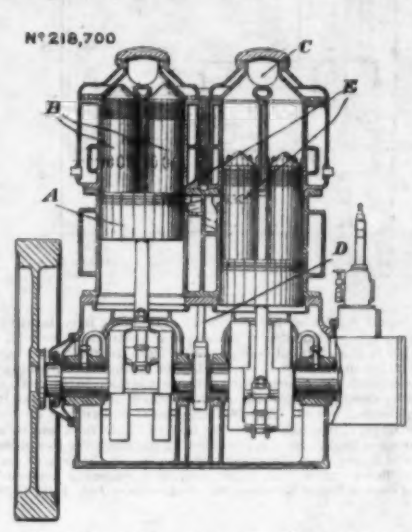
This invention relates to valves operating gears for internal combustion engines, where the valves are worked by cams in the usual manner and are brought back against the cams by the



pressure of the air compressed by a shock-absorbing device in the form of a piston carried on the valve rod. The initial pressure of the air in the cylinder of the pneumatic shock-absorbing device is maintained constant by a compressor or other means. The valve A slides in the guide B and at its upper part is provided with a piston C, which works on a cylinder D, formed by the upper part of the guide B. A series of ports or holes E are provided at the upper centre of the piston, which communicate with the tube F leading to a small compressor or other source of compressed air. The pressure in the cylinder is regulated to obtain the necessary pressure on the piston to return the valve. The valve is worked by a cam G in the usual manner, and it is claimed that the invention enables the reaction spring H to be partly or wholly done away with. By modifying the position of the ports E, the pressure on the cam may be varied. Thus, the cam profile may be so designed as to provide a maximum area of opening of the valve with a minimum acceleration, which is constantly equal to that which is produced by the compressed air.—*July 17th*, 1924.

218,700. February 9th, 1923.—Improvements in Internal Combustion Engines, John Davidson, The Elms, Tutbury, Burton-on-Trent.

This invention relates to Diesel engines or hot bulb engines with one or more pump pistons A connected to the crank shaft with two working pistons B attached to each pump piston. The two working cylinders in each piston group are joined together at the top, forming a combustion space C, and means are provided for the injection of fuel. Both working cylinders are furnished with ports, the two outer cylinders being fitted with exhaust ports and the two inner cylinders with inlet ports. The pump cylinders draw air from the atmosphere, which supply is controlled by a centrally placed piston valve operated by the excentric D. Connection between the piston valve control ports

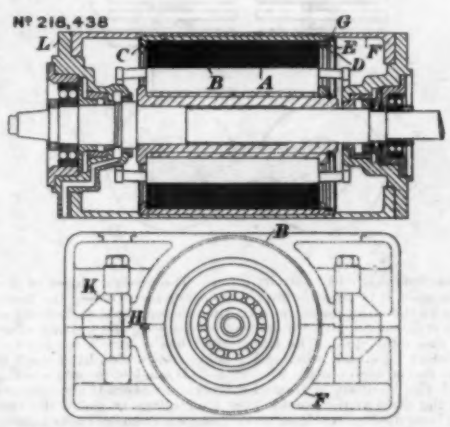


and the pump cylinders is made through ports E. During the working stroke of one set of pistons air is drawn into the pump cylinder through the piston valve, while at the same time air is compressed in the other pump cylinder. At the end of the working stroke of the first set of working pistons the piston valve admits compressed air through the inlet ports in the working cylinder, which passes round the cylinder spaces and sweeps out the products of combustion through the exhaust ports. Various details of the proposed design are reproduced in diagrammatic form. The pump cylinders are cut off from the crank chamber and the improved construction is claimed to give increased power for a given consumption of fuel oil without consuming any of the lubricating oil supplied to the engine.—*July 9th*, 1924.

DYNAMOS AND MOTORS.

218,438. May 17th, 1923.—Improvements in Alternating-current Motors for Coal-cutting Machines and the like, William Archibald Logan, of 8, Havelock-street, Glasgow, W.

The object of this invention is to provide a construction which, notwithstanding restriction of height, permits the employment of wide machine-faced joints so as to render the motor water-tight and dust-proof. Another object is to facilitate the winding of the stator. The motor described in the specification includes a housing for the stator laminations A, the housing being in the form of a steel tube B having a fixed flange C at one end and arranged to receive at the other end a loose flange or

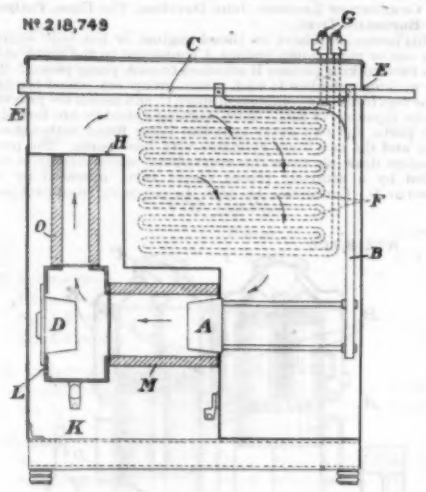


washer D which is held in position by a spring ring E engaging a groove in the internal wall of the tube and inserted in the groove after the laminations have been pressed into position. The yoke F is internally recessed at G to receive the tube, the end boundaries of the recess serving as shoulders to prevent endwise movement of the tube relatively to the yoke. The laminations are restrained against angular movement by a key. The yoke F is formed in halves, being divided longitudinally diametrally of the tube, the halves being formed to constitute a longitudinal spigot joint at H and being bolted together by vertical bolts K and covers L bolted to the yoke completing the structure.—*July 10th*, 1924.

218,749. April 12th, 1923.—Improvements in Liquid Controllers for Two and Three-phase Slip-ring Motors, Allen West and Co., Limited, and Allen West, both of Lewes-road, Brighton, Sussex.

Two methods of constructing a controller according to this

invention are described, and the drawing relates to one of them. The movable electrodes A are attached to the lower ends of bars B, which are attached to horizontal bars C. The electrodes are immersed in the resistance liquid and oppose the fixed electrodes D, which are mounted within earthenware pots in the usual manner. The horizontal bars C slide within bearings E above the resistance liquid, and one end of each bar projects beyond the tank to enable a connection to be made with the actuating gear. The resistance liquid may be cooled by means of pipes F, arranged within the tank. Cooling water is circulated by way of the connections G. A system of induced circulation for the resist-

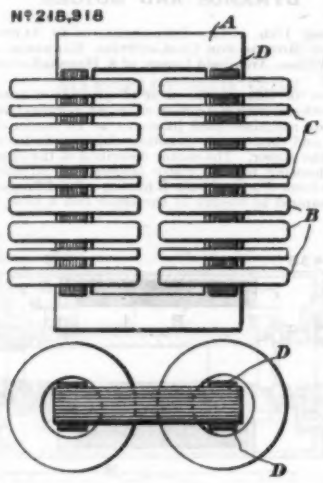


ance liquid may also be provided. The tank may be divided into two compartments by means of a partitional wall H, the chamber K thus formed being isolated from the resistance liquid. Within this chamber K there is a box or casing L, containing the fixed electrodes D. The interior of the box is open to the resistance liquid by means of a porcelain pot M, which constitutes the inlet for the cooled liquid. A porcelain pipe O constitutes an outlet or return pipe, through which the heated liquid rises and returns to the main tank, where it is cooled by passing over the pipes F. The cold liquid thus always enters one end of the box or casing L, and flows out at the other end, thus ensuring a continual flow of cooled liquid between the electrodes.—*July 14th*, 1924.

TRANSFORMERS AND CONVERTERS.

218,918. December 7th, 1923.—IMPROVEMENTS IN AND RELATING TO ELECTRIC TRANSFORMERS, *The British Thomson-Houston Company, Limited, Crown House, Aldwych, London, W.C. 2.*

In the operation of a transformer, the main magnetic flux which links the primary and secondary windings is substantially confined to the magnetic core, but there is always some leakage or stray flux which leaves the windings, and then finds its way back into them through paths outside the core. In some transformers, the amount of leakage flux is considerable, especially in transformers having large reactance, and it always seeks the easiest return paths which may include winding and core clamps and other structural magnetic parts, which are not formed of proper material nor suitably laminated to prevent objectionable

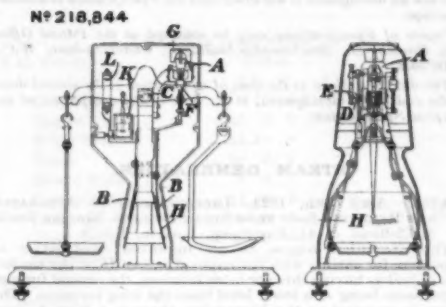


hysteresis and eddy current losses. The general object of this invention is to provide improved means for reducing the losses due to the stray magnetic flux, thus increasing the efficiency of the transformer and eliminating or reducing the heating effect of this stray flux. The transformer has a core A having two winding legs, each winding leg being surrounded by a stack of interleaved high-tension winding coils B and low-tension winding coils C. Auxiliary laminated magnetic members D are mounted on the faces of the outside core laminations to shield the core leg from flux approaching it crosswise with respect to its laminations. The laminations of these auxiliary shielding members D are at right angles to the laminations of the shielded core, so that the stray flux will enter and leave them edgewise with minimum resulting eddy currents.—*July 17th*, 1924.

MEASURING AND TESTING INSTRUMENTS.

218,844. July 12th, 1923.—IMPROVEMENTS RELATING TO WEIGHING APPARATUS, Charles W. Brecknell, Limited, and James Beech, all of 20–22, Lombard-street, Birmingham.

The object of the invention is to provide in conjunction with the apparatus a chart or scale and index at a position below the beam, so that it can be viewed from one or both ends of the apparatus. Transversely across and over or under one arm of the beam is arranged a pendulous lever A, and to the lower end of it is attached an index B. This lever serves not only to operate the index from the beam, but also to effect the required change of directions of motion from one plane to another at right angles. The lever is pivoted on a bearing C arranged at the upper end of the standard, and connection is made between the lever and a lateral projection D at one side of the beam by a shackle E through point and cup or other suitable bearing pieces. The lever A is provided with balancing or loading weigh s F G, one of which, F, is adjustable. The lever oscillates in a plane at right angles to that of the beam, and the index at its lower end

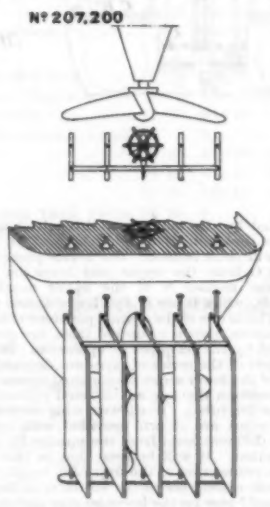


co-operates with a scale or chart H arranged near the lower end of the standard transversely across the apparatus. Two charts may be employed if desired, each visible from one end of the apparatus. A dashpot K, paddle or other damping arrangement may be arranged in conjunction with the other arm of the beam or lever. Stops L serve to limit the oscillation of the beam.—*July 17th*, 1924.

SHIPS AND BOATS.

207,200. November 19th, 1923.—IMPROVEMENTS IN SHIPS' RUDDERS, "*N.V. Flettner's Scheepsroermij*," *of No. 3, re Willemsplein, Rotterdam, The Netherlands.*

This invention has for its object to provide an improved ship's rudder whereby the rudder action can be rendered very effective up to a very large angle of deflection of the rudder. The improved rudder is made in the form of a grating which is composed of a

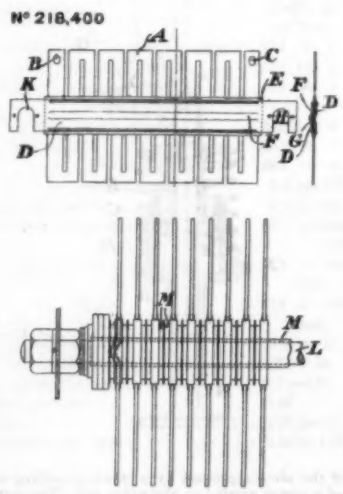


number of parallel plates acting as rudder blades and arranged on the rudder spindle in such a manner that the blades operate in a common wash of the ship, for instance in the wash of the ship's propeller or propellers. The two outer rudder blades limit the common wash of the ship or ship's propeller and act as guides for the wash in respect of the intermediate rudder blade or blades.—*July 10th*, 1924.

MISCELLANEOUS.

218,400. April 11th, 1923.—IMPROVEMENTS RELATING TO ELECTRICAL RESISTANCES, Noel George Langrish, of The Paddock, Barker's-lane, Ashton-on-Mersey, and Metropolitan-Vickers Electrical Company, Limited, of 4, Central-buildings, in the City of Westminster.

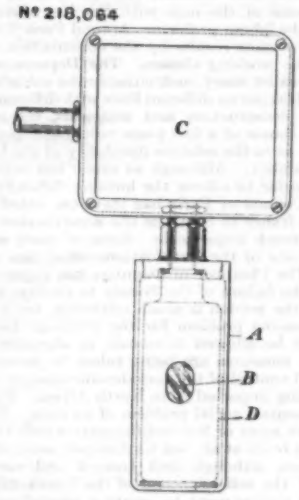
The resistance grid described in this specification consists of



a resistance conductor A in the form of a zig-zag, the ends or terminals of which are indicated at B and C. The resistance conductor is provided on either side with a strengthening strip D, insulating material E being disposed between each strengthening strip and the conductor A. A corrugation F is provided along each strengthening strip and the corrugations are adapted to register with a similar corrugation G formed along the grid. The ends of the strengthening strips D are connected together by spot-welding as indicated at H and the ends are provided with slots K which are adapted to engage tie bolts whereby a number of grids may be mounted in a frame in the well-known manner. The tie bolts L are provided with insulating sleeves M on which the slots K formed in the ends of a number of the strengthening strips D are engaged. Spacing washers are provided between the grids washers.—*July 10th*, 1924.

218,064. May 8th, 1923.—IMPROVEMENTS IN OR RELATING TO MEANS FOR MAINTAINING THE INSULATION RESISTANCE OF ELECTRIC CABLES AND THE LIKE, W. T. Henley's Telegraph Works Company, Limited, 13 and 14, Bloomfield-street, London-wall, E.C. 2; and Percy Dunsheath, of W. T. Henley's Telegraph Works, Limited, Telegraph Works, North Woolwich, E. 16.

The object of this invention is to keep the air dry in fuse boxes



and conduit systems, &c. A de-hydrator casing A with inspection apertures B is attached to the fuse or other box C as shown. Inside the casing of the de-hydrator there is an open bottle D which is filled with the de-hydrating material.—*July 3rd*, 1924.

Forthcoming Engagements.

Secretaries of Institutions, Societies, &c., desirous of having notices of meetings inserted in this column, are requested to note that, in order to make sure of its insertion, the necessary information should reach this office on, or before, the morning of the Wednesday of the week preceding the meetings. In all cases the TIME *and* PLACE *at which the meeting is to be held should be clearly stated.*

THURSDAY AND FRIDAY, SEPTEMBER 4TH AND 5TH.

IRON AND STEEL INSTITUTE.—British Empire Exhibition, Wembley. Autumn meeting. For programme see page 104.

MONDAY TO THURSDAY, SEPTEMBER 8TH TO 11TH.

INSTITUTE OF METALS.—Institution of Mechanical Engineers, Storey's-gate, Westminster, S.W. 1. Autumn meeting. For programme see page 132.

TUESDAY, SEPTEMBER 9TH.

INSTITUTE OF MARINE ENGINEERS.—85/88, The Minories, Tower Hill, London, E. 1. "The Measurement of Pressure," by Mr. J. L. Hodgson. 6.30 p.m.

TUESDAY AND WEDNESDAY, SEPTEMBER 10TH AND 17TH.

INSTITUTION OF PUBLIC LIGHTING ENGINEERS AND SUPERINTENDENTS. Annual meeting in Glasgow. For programme, see page 181.

TUESDAY, SEPTEMBER 23RD.

INSTITUTE OF MARINE ENGINEERS.—85/88, The Minories, Tower Hill, London, E. 1. "An Engineer's Life in Eastern Oilfields," by Mr. E. B. Seymour Norton. 6.30 p.m.

CONTRACTS.

THE GENERAL STEAM NAVIGATION COMPANY, Limited, London, has placed an order with J. Samuel White and Co., Limited, of Cowes, Isle of Wight, for the building of a fast paddle steamer for the summer passenger service between London, Margate, and Ramsgate. The vessel, which will be 300ft. in length, will be fitted with all the latest improvements for the convenience and comfort of passengers, and will be built under the supervision of Mr. William Gray, London, the naval architect and consul ing engineer to the company.

ORDERS have been placed with the Westinghouse Brake and Saxby Signal Co., Limited, for a complete automatic electro-pneumatic decking plant at the Great Western Colliery Company's new pit, Tymawr Field. The plant includes interlocking and simultaneous decking for two deck cages, power-operated gates, and control of auxiliary cages. The same firm has also received an order for electro-pneumatic decking plant at the United Steel Company's Orgreave Colliery, Staple Pit Top, which includes track rams, skotch blocks, &c., for decking their two deck cages at one banking level.

THE ENGLISH ELECTRIC COMPANY, Limited, informs us that it has received an order from the proprietors of the Snowdown Colliery, which is situated about 10 miles from Canterbury, for an electrically driven winder, designed to deal with an output of 144 tons per hour from a depth of 3100ft., the net weight per lift being 3 tons. The winding motor is to be direct coupled to a winding drum of cylindro-conical type, and will have a continuous rating of 2300 brake horse-power at 61.2 revolutions per minute. This will, it is claimed, be the largest single self-ventilated motor operating a winder in this country, if not in the world.